REGISTER

OF

THE LEHIGH UNIVERSITY,

1888-1889.

TUITION FREE.

SOUTH BETHLEHEM, PA.
1889.

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OF

THE LEHIGH UNIVERSITY,

SOUTH BETHLEHEM, PA.,

1888-1889.

FOUNDED BY ASA PACKER.

TUITION FREE.

BETHLEHEM, PA.
THE COMENIUS PRESS.
1889.

TABULAR ALMANAC.

1888.

JULY.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...
...	...	...	...	...	...	...

AUGUST.

S	M	T	W	T	F	S
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...
...	...	...	...	...	...	...

SEPTEMBER.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	...	...	...	...	...	...

OCTOBER.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...
...	...	...	...	...	...	...

NOVEMBER.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	...
...	...	...	...	...	...	...

DECEMBER.

S	M	—	W	T		S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	...	...	...	...	...

1889.

JANUARY.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...
...	...	...	...	...	...	...

FEBRUARY.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	...	...
...	...	...	...	...	...	..

MARCH.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	...	...	...	...	...	...

APRIL.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	...	...	...	...
...	...	...	...	...	...	...

MAY.

S	M	T	W	T	F	S
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...
...	...	...	...	...	...	...

JUNE.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	..	...	...	...	...	...

JULY.

S	M	T	W	T	F	S
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...
...	...	...	...	...	...	...

AUGUST.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
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SEPTEMBER.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	...	...	...	...	...
...	...	...	...	...	...	...

OCTOBER.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...
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NOVEMBER.

S	M	T	W	T	F	S
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
...	...	...	...	...	...	...

DECEMBER.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...
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1890.

JANUARY.

S	M	T	W	T	F	S
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...
...	...	...	...	...	...	...

FEBRUARY.

S	M	T	W	T	F	S
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	...
...	...	...	...	...	...	...

MARCH.

S	M	T	W	T	F	S
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	...	...	...	...	...

APRIL.

S	M	T	W	T	F	S
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	...	...	...
...	...	...	...	...	...	...

MAY.

S	M	T	W	T	F	S
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
...	...	...	...	...	...	...

JUNE.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	...	...	...	...	...
...	...	...	...	...	...	...

CALENDAR.

1888-1889.

1888.		
Sept. 10, 11, 12,	Monday, Tuesday and Wednesday,	Examinations for Admission.
Sept. 12,	Wednesday,	First Term begins.
Oct. 11,	Thursday,	Founder's Day.
Nov. 29,	Thursday,	Thanksgiving Day.
Dec. 19,	Wednesday,	First Term ends.
1889.		
Jan. 8, 9,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 9,	Wednesday,	Second Term begins.
Jan. 19,	Saturday,	Junior Prize Orations due.
Feb. 22,	Friday,	Washington's Birthday.
March 6,	Wednesday,	Ash Wednesday.
April 18,	Thursday,	Easter Holidays begin.
April 23,	Tuesday,	Easter Holidays end at 8¼ A.M.
May 27,	Monday,	University-Day Orations due.
May 29,	Wednesday,	Theses of Seniors due.
May 29,	Wednesday,	Senior Examinations begin
June 5,	Wednesday,	Annual Examinations begin.
June 8,	Saturday,	Senior Examinations end.
June 12, 13, 14,	Wednesday, Thursday and Friday,	Examinations for Admission.
June 16,	Sunday,	Baccalaureate Sermon.
June 18,	Tuesday,	Class Day.
June 19,	Wednesday,	Alumni Day.
June 20,	Thursday,	University Day.

1889-1890.

1889.		
Sept. 7, 9, 10,	Saturday, Monday, and Tuesday,	Examinations for Admission.
Sept. 11,	Wednesday,	First Term begins.
Oct. 10,	Thursday,	Founder's Day.
Nov. 28,	Thursday,	Thanksgiving Day.
Dec. 18,	Wednesday,	First Term ends.
1890.		
Jan. 7–8,	Tuesday and Wednesday,	Examinations for Admission to Second Term.
Jan. 8,	Wednesday,	Second Term begins.
June 19.	Thursday,	University Day.

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ARTHUR E. MEAKER, C.E.,
Instructor in Mathematics.

HARVEY S. HOUSKEEPER, B.A.,
Instructor in Physics.

PRESTON A. LAMBERT, B.A.,
Instructor in Mathematics.

FONGER DE HAAN, C.N.L.,
Instructor in Modern Languages.

LESTER P. BRECKENRIDGE, PH.B.,
Instructor in Mechanical Engineering.

HENRY S. JACOBY, C.E.,
Instructor in Civil Engineering.

FRED. PUTNAM SPALDING, C.E.,
Instructor in Civil Engineering.

GEORGE F. DUCK, E.M.,
Instructor in Mining.

CHARLES W. MARSH, PH.D., F.C.S.,
Instructor in Organic and Industrial Chemistry.

JOSEPH W. RICHARDS, M.A., A.C.,
Instructor in Metallurgy and Blowpiping.

LEWIS BUCKLEY SEMPLE, B.A.
Instructor in Rhetoric.

R. M. HUSE, M.A.,
Instructor in Modern Languages.

JOHN J. FLATHER, PH. B.,
Instructor in Mechanical Engineering.

LIONEL R. LENOX, PH.B.,
Instructor in Qualitative Analysis and Assaying.

GEORGE M. RICHARDSON, A.C.,
Instructor in Quantitative Analysis.

SAMUEL W. FRESCOLN, C.E.,
Assistant to Professor of Civil Engineering.

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Director,
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CHARLES F. SEELEY.

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A. W. STERNER.

Cataloguing Clerk,
WILSON F. STAUFFER.

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PETER F. STAUFFER.

STUDENTS.

Clas.—Classical Course.	C.E.—Civil Engineering.
L.S.—Latin-Scientific Course.	E.M.—Mining Engineering.
Sci.—Course in Science and Letters.	M.E.—Mechanical Engineering.
Tech.—Technical Course.	Met.—Metallurgy.
A.C.—Analytical Chemistry.	E.E.—Electrical Engineering.

The students whose names are printed in *italics* are not clear of conditions.

GRADUATES.

	FOR DEGREE.	RESIDENCE.
Francis Joseph Crilly, B.A.,	M.A.,	Philadelphia.
William Henry Dean, A.C.,E.M.,	M.S.,	Wilkes-Barre.
George Francis Duck, E.M.,	Ph.D.,	Bethlehem.
Milton Henry Fehnel, B.S.,	A.C.,	Bethlehem.
Harvey Sheafe Fisher, B.A.,	M.A.,	Pottsville.
Samuel Wilson Frescoln, C.E.,	M.S.,	Reading.
Louis Prevost Gaston, B.S.,	C.E.,	Somerville, N. J.
William Kendall Gillett, M.A.,	Ph.D.,	New York City.
John Daniel Hoffman, B.A.,	M.A.,	Bethlehem.
Robert Browne Honeyman, B.S.,	E.M.,	Bethlehem.
Preston Albert Lambert, B.A.,	M.A.,	South Bethlehem.
Elmer Henry Lawall, C.E.,	M.S.,	Audenried.
Alfred Eli Lewis, jr., B.S.,	E.M.,	Milford.
Wilson Franklin More, B.A.,	M.A.,	Catasauqua.

	Course.	Residence.
George Spencer Patterson, E.M.,	M.S.,	Mahanoy City.
Albert George Rau, B.S.,	M.S.,	Bethlehem.
Joseph William Richards, A.C.,	M.S.,	Bethlehem.
George Arthur Ruddle, Ph.B.,	M.A.	E. Mauch Chunk.
Lewis Buckley Semple, B.A.,	M.A.,	Bethlehem.
Wyndham Harvey Stokes, B.S.,	E.M.,	Gordonsville, Va.
William Patterson Taylor, B.A.,	M.A.,	Philadelphia.
Wade Hampton Woods, B.S.,	E.M.,	Philadelphia.

SENIOR CLASS.

	Course.	Residence.
James Willoughby Anderson,	E.M.,	Washington, D.C.
Pearce Atkinson,	M.E.,	Chicago, Ill.
Gustav Ayres,	M.E.,	Washington, D.C.
Ralph Putnam Barnard,	C.E.,	Washington, D.C.
Albert Harlan Bates,	M.E.,	Cleveland, O.
Samuel Erwin Berger,	Clas.,	Richland Centre.
Charles Hudson Boynton,	L.S.,	Washington, D.C.
Joseph Leander Budd,	A.C.,	Mount Holly, N. J.
Otto Cornelius Burkhardt,	E.M.,	Bethlehem.
William Butterworth,	M.E.,	Cincinnati, Ohio.
Edgar Campbell,	Clas.,	South Bethlehem.
Francis Joseph Carman,	A.C.,	Washington, D.C.
Herbert Mackenzie Carson,	M.E.,	Baltimore, Md.
Holden William Chester,	C.E.,	Shamokin.
Charles William Corbin,	E.M.,	Telluride, Col.
Justice Cox Cornelius,	C.E.,	Pittsburgh.
William Albert Cornelius,	M.E.,	Pittsburgh.

	COURSE.	RESIDENCE.
Charles Herbert Deans,	C.E.,	Phœnixville.
Charles Estell Dickerson, jr.,	Sci.,	New Germantown, N. J.
Emil Diebitsch,	C.E.,	Washington, D.C.
John Webster Dougherty,	E.M.,	Steelton.
Ralph Marshall Dravo,	E.M.,	Allegheny.
Ernest Hipolite Du Vivier,	A.C.,	New York City.
William Dolloway Farwell,	Clas.,	Oswego, N. Y.
Frederick Louis Grammer,	E.M.,	Baltimore, Md.
George Wentz Harris,	E.M.,	Silver Brook.
Lightner Henderson,	C.E.,	Gap.
Conrad Egbert Hesse,	E.M.,	Washington, D. C.
Clarence Walter Hudson,	C.E.,	Manasquan, N. J.
Arch Johnston,	M.E.,	Bethlehem.
John Stower Kellogg, jr.,	A.C.,	Atchison, Kan.
John Martin Sharpless Kerlin,	M.E.,	Elwyn.
Sylvanus Elmer Lambert,	Clas.,	Seidersville.
John Joseph Lincoln,	C.E.,	Farmington, Md.
John Lockett,	M.E.,	Glengoffe, Jamaica.
Arthur Long,	A.C.,	Wilkes-Barre.
John Joseph Martin,	C.E.,	New York, N. Y.
Charles Henry Miller,	A.C.,	Norristown.
Charles Williams Moffett,	M.E.,	Athens, Greece.
Richard Henry Morris, jr.,	E.M.,	Bristol.
William Ellis Morris,	A.C.,	Portland, Ore.
John Thomas Morrow,	M.E.,	Washington, D.C.
Albert Daniel Oberly,	C.E.,	Easton.
Joseph Michael O'Malley,	A.C.,	Wilkes-Barre.
Robert Henry Eddy Porter,	M.E.,	Morristown, N. J.
Arnold Karthaus Reese,	E.M.,	Baltimore, Md.
Abraham Lincoln Rogers,	M.E.,	Fort Wayne, Ind.
Charles William Schwartz, jr.,	M.E.,	Germantown.

	COURSE.	RESIDENCE.
Arthur Moult Smyth,	E.M.,	Philadelphia.
Alfred Walton Stockett,	C.E.,	Mauch Chunk.
Lester Clark Taylor,	C.E.,	Pawtucket, R. I.
Augustus Thompson Throop,	C.E.,	Port Gibson, N.Y.
Charles Prentice Turner,	M.E.,	Oxford, N. Y.
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Edward Austin Wright,	C.E.,	Northampton, Mass.
Joseph Bodine Wright,	C.E.,	South Easton.

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Howard Emory Alcott,	M.E.,	Mt. Holly, N. J.
Thos. Chalkley James Baily, jr.,	C.E.,	Newark, N. J.
Frederick Richard Barrett,	C.E.,	Fort Marcy, N. M.
Edwin Herbert Beazell,	C.E.,	Chillicothe, Mo.
James W. Boyd,	C.E.,	Seek.
Adolph Cardenas,	C.E.,	Nicaragua.
Franklin Clarke, Jr.,	M.E.,	Vincennes, Ind.
William Phelps Cleveland,	A.C.,	Waterville, N. Y.
Frank Raymond Coates,	E.M.,	Philadelphia.
Warren Scott Cope,	C.E.,	Philadelphia.
Charles Ellery Coxe,	E.M.,	Reading.
James Barlow Cullum,	A.C.,	Meadville.
John Rose Davis,	C.E.,	Phœnixville.
John William DeMoyer,	C.E.,	Duncannon.

	COURSE.	RESIDENCE.
Clement Heyser Detwiler,	C.E.,	Ironbridge.
Charles Edward Fink,	C.E.,	Harrisburg.
Frederick Elmer Fisher,	C.E.,	New York City.
Frank Roberts Fisher,	C.E.,	Philadelphia.
John George Fleck,	C.E.,	Philadelphia.
Howard Augustus Foering,	Sci.,	Locust Valley.
Arthur Hugh Frazier,	Clas.,	South Bethlehem.
Eugene Uz Gibbs,	M.E.,	Mt. Holly, N. J.
Ralph Goodman,	C.E.,	Atglen.
George Ellsworth Greene,	C.E.,	Rochester, N. Y.
Harry Walter Harley,	M.E.,	Gloucester, N. J.
David Garth Hearne,	C.E.,	Wheeling, W. Va.
James Stevens Bush Hollinshead,	E.M.,	Dayton, O.
John Turner Hoover,	C.E.,	Philipsburg.
Frederic Kidder Houston,	M.E.,	New York City.
Alexander Chambers Howard,	E.M.,	Pittsburgh.
Christopher Gadsen Howe,	C.E.,	Charleston, S. C.
William Vincent Kulp,	C.E.,	Norristown.
Henry Meyers Kurtz,	C.E.,	Allentown.
John Elmer Litch,	M.E.,	Steelton.
Thomas Smith Leoser,	A.C.,	New York City, N. Y.
Robert Sayre Mercur,	E.M.,	Wilkes-Barre.
Charles Herbert Miller,	A.C.,	Huntingdon.
George Nauman, jr.,	C.E.,	Lancaster.
Robert Engler Neumeyer,	C.E.,	Bethlehem.
William Cassidy Perkins,	C.E.,	Williamsport.
Asa Emory Phillips,	C.E.,	Washington, D.C.
Edward Williams Pratt,	M.E.,	Fort Atkinson, Wis.
Edwin Jay Prindle,	M.E.,	Washington, D.C.
Wallace Carl Riddick,	C.E.,	Wake Forest, N. C.
John Stover Riegel,	M.E.,	Riegelsville, N. J.

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Joseph Edgar Sanborn,	A.C.,	Bellows Falls, Vt.
Ellis Anstett Schnabel,	Clas.,	Bethlehem.
Harry Johns Sherman,	C.E.,	Mount Holly, N.J.
William Calvin Shoemaker,	C.E.,	Reading.
William Alston Stevenson,	M.E.,	Lewistown.
R. Paul Stout,	M.E.,	Audenried.
Theodore Alfred Straub,	C.E.,	Allegheny.
Francis Dupont Thomson,	M.E.,	Philadelphia.
Charles Cookman Tomkinson,	M.E.,	Harrisburg,
Claud Allen Porter Turner,	C.E.,	Lime Rock, R. I.
Aaron Howell Van Cleve,	C.E.,	Easton.
Fritz August Weihe,	M.E.,	Wonneberg, W. Prussia.
David Thomas Williams,	M.E.,	Catasauqua.
Herbert Wright,	M.E.,	Northampton, Mass.

SOPHOMORE CLASS.

	COURSE.	RESIDENCE.
George Kerr Anderson,	E.M.,	Franklin.
Murray Blatchley Augur,	E.E.,	Washington, D. C.
Hugh Cunningham Banks,	C.E.,	Savannah, Ga.
Juan de la Rosa Barrios,	E.M.,	Bogota, U. S. Colombia.
John Mayall Beaumont,	M.E.	Scranton.
John Bush Beck, Jr.,	M.E.,	Williamsport.
Harry Weed Biggs,	C.E.,	Glendale, O.
James Edwin Boatrite,	C.E.,	Columbus, Ga.
Herman Stadiger Borhek,	E.E.,	Bethlehem.
Charles Marcus Breder,	E.M.,	Bethlehem.
George Briggs,	E.E.,	Scranton.
Jacob Burr Buckley,	E.E.,	Oxford, N. Y.

	Course.	Residence.
Walter Frederick Burden,	C.E.,	Washington, D. C.
Frederick Stanley Camp,	E.E.,	Brooklyn, N. Y.
George Vose Chandler,	E.M.,	Washington, D. C.
Emanuel Chao,	C.E.,	Cienfuegos, Cuba.
Henry Clark, Jr.,	E.M.,	Montgomery City, Mo.
Charles Houghton Corbin,	A.C.,	Telluride, Col.
Edward Haviland Coxe,	C.E.,	Reading.
Warder Cresson,	M.E.,	Swarthmore.
Andrew Gilbert Croll,	M.E.,	Weatherly.
Francis Hewette Davis,	M.E.	Watkins, N. Y.
Frederick Davis,	E.E.,	Watkins, N. Y.
Herman Haupt Davis,	M.E.,	Philadelphia.
Morgan Davis,	E.M.,	Mt. Carmel.
Eric Doolittle,	C.E.,	Bethlehem.
Daniel Edward Downey,	E.M.,	South Bethlehem.
Percival Drayton,	M.E.,	Philadelphia.
Abben Eavenson,	A.C.,	Philadelphia.
Harry S. Eckert,	A.C.,	Reading.
Lester Hallett Ely,	A.C.,	New York, N. Y.
Delevan Emery,	A.C.,	Bradford.
Fitz Daniel Ermentrout,	L.S.,	Reading.
Juan de la Cruz Escobar,	M.E.,	Matanzas, Cuba.
Walter Lowe Fairchild,	E.E.,	Elmira, N. Y.
Walter Famaris,	C.E.,	Beverly, N. J.
Walton Forstall,	E.E.,	Chicago, Ill.
John Stilwell Griggs,	M.E.,	New Haven, Conn.
George Samuel Hayes,	C.E.,	Painesville, O.
Julian Greene Hearne,	E.E.,	Wheeling, W. Va.
John Sidney Heilig,	M.E.,	Catasauqua.
William Albert Heindle,	C.E.,	Baltimore, Md.
John Franklin Hersh,	C.E.,	Allentown.

	Course.	Residence.
Hermann Victor Hesse,	E.M.,	Bethlehem.
Ralf Ridgway Hillman,	E.M.,	Wilkes-Barre.
Paul Depue Honeyman,	E.E.,	Bethlehem.
Amos Dey Kennedy, jr.,	E.E.,	Philadelphia.
Harry Hiram King,	M.E.,	Bethlehem.
Juan Jose Jimenez,	C.E.,	Aguadilla, Porto Rico.
Henry Kemmerling,	C.E.,	Scranton.
Hermann Meriwether Knapp,	C.E.,	Louisville, Ky.
Harry Kramph,	C.E.,	North Platte, Neb.
John LeDroit Langdon,	E.E.,	Buffalo, N. Y.
Frederic Curtiss Lauderburn,	Clas.,	Hazleton.
Henry Lefevre,	E.M.,	Panama, U.S.Colombia.
Charles McKnight Leoser, jr.,	E.M.,	New York City, N. Y.
Frank King Leslie,	A.C.,	Sharon.
Henry Washington Lloyd, jr.,	M.E.,	Stanhope, N. J.
Joseph Simonson Lockwood,	E.E.,	Brooklyn, N. Y.
Nevin John Loos,	E. M.	Bethlehem.
Joseph Macfarland,	A. C.,	Washington, D. C.
Simon Strock Martin,	A.C.,	Steelton.
Allan Moore Masser,	A.C.,	Scranton.
William David Matheson,	A.C.,	Brooklyn, N. Y.
John Zollinger Miller,	E.E.,	Harrisburg.
Robert Douglas Millholland,	E.E.,	Reading.
George Smuller Mish,	C.E.,	Middletown.
Daniel MacFarlan Moore,	M.E.,	Bethlehem.
Harry Timothy Morris,	M.E.,	Pottsville.
Horatio Whittemore Myrick,	E.E.,	Springfield, Mass.
Alexander Leutze McClurg,	E.M.,	Chambersburg.
James Anderson McClurg,	E.M.,	Meadville.
Henry Stewart McKee,	E.M.,	Washington, D. C.,
Paul Mayo Paine,	C.E.,	Troy.

	Course.	Residence.
Edwin Addams Quier,	A.C.,	Reading.
James Pius Rafferty,	M.E.,	Chicago, Ills.
Walter Freeman Rench,	C.E.,	Cumberland, Md.
John Ira Riegel,	C.E.,	South Bethlehem.
Milton Holly Robbins, jr.,	M.E.,	Lakeville, Conn.
Robert Schmitz,	C.E.,	Egg Harbor City, N. J.
Anton Schneider,	C.E.,	Summit Hill.
Leidy Rudy Shellenberger,	C.E.,	Benjamin.
Ira Augustus Shimer,	Clas.,	Redington.
Charles Henry Simpson,	C.E.,	Pensacola, Fla.
Matthew Charles Smith,	C.E.,	Birmingham, Ala.
Oscar Emmerson Smith,	C.E.,	Portsmouth, Va.
Michael Druck Sohon,	A.C.,	Washington, D. C.
William Buchecker Spengler,	M.E.,	Bethlehem.
Horace Theodore Stilson,	C.E.,	Cleveland, Ohio.
Joseph William Stone,	M.E.,	New Orleans, La.
Mercer Brown Tate,	M.E.,	Harrisburg.
William Sidney Topping,	L.S.,	Sagg, N. Y.
Domingo Anthony Usina,	C.E.,	Savannah, Ga.
Michael Neligan Usina,	E.E.,	Savannah, Ga.
Elias Vander Horst,	C.E.,	Charleston, S. C.
William Alder Webb,	M.E.,	Bethlehem.
George Edward Wendle,	E.E.,	Philadelphia.
Francis Nichols Whitney,	M.E.,	Pottsville.
George Brown Zahniser,	C.E.,	Mercer.

FRESHMAN CLASS.

	COURSE.	RESIDENCE.
Charles Henry Allam,	C.E.,	South Bethlehem.
William North Robins Ashmead,	Clas.,	Minersville.
George William Ballock Asmussen,	C.E.,	Washington, D. C.
Herbert Burr Atha,	C.E.,	Newark, N. J.
George Haldeman Atkins,	C.E.,	Pottsville.
Hanson Entriker Atkins,	M.E.,	Pottsville.
Robert Ligget Baird,	C.E.,	Philadelphia.
Noble Banks,	C.E.,	Savannah, Ga.
Joseph Barrell,	E.M.,	New Providence, N, J.
Charles Bartles, jr.,	E.M.,	Williamsport.
John Young Bassell, jr.,	E.E.,	Leesburg, Va.
John Newbaker Bastress,	C.E.,	Sunbury.
Finus Earl Blakeney,	C.E.,	Little Rock, Ark.
Herman Renner Blickle,	C.E.,	Cincinnati, Ohio.
Samuel Branson,	M.E.,	Wrightstown, N. J.
George Jones Bridgers,	C.E.,	Wilmington, N. C.
Alfred Tennyson Brown,	E.E.,	Rising Sun, Ind.
John Emery Bucher,	A.C.,	Hanover.
Charles Merritt Case,	M.E.,	Minneapolis, Minn.
George Price Case,	M.E.,	Minneapolis, Minn.
Philip Lothrop Cobb,	C.E.,	Cleveland, Ohio.
Samuel Dewey Cushing,	E.M.,	Washington, D.C.
Heber Denman,	E.M.,	Kendall Creek, Pa.
Heber Thornton Dickerman,	C.E.,	Chapman Quarries.
Edwin Dodge,	E.M.,	Gouverneur, N. Y.
Robert Arthur Downey,	C.E.,	Oswego, N. Y.
Howard Weidener DuBois,	E.M.,	Philadelphia.

	Course.	Residence.
Philip Garrett Eastwick, jr.,	E.E,,	Portland, Oregon.
Harry Clifford Eddy,	E.E.,	Morristown, N. J.
George Washington Engle,	E.M.,	Ashland.
Edward Fargason,	M.E.,	Memphis, Tenn.
Arthur Haldeman Fetters,	M.E,	Barneston.
George Buchanan Fife,	C.E.,	Washington, D. C.
Henry Cowan Blair Finley,	E.M.,	Chattanooga, Tenn.
Ralph Stillman Garwood,	Clas.,	Bethlehem.
William Lasher Gilmore,	E.E.,	New York City, N. Y.
Thanlow Gjersten,	C.E.,	Saxton.
Samuel Morrison Graham,	M.E.,	Phillipsburg.
William Harry Goll,	C.E.,	Lancaster.
John Adams Gruver,	Clas.,	Springtown,
Cornelius Silsby Hawkins,	E.E.,	Fall River, Mass.
Edwin Paul Hazel,	M.E.,	Cressona.
Howard Bright Heller,	M.E.,	South Bethlehem.
Charles Miller Hobbs,	E.E.,	Hulmesville.
Benjamin Williams Homans,	C.E.,	Brooklyn, N. Y.
George Washington Howard, jr.,	E.E.,	Hagerstown, Md.
Hartley Howard, jr.,	E.E.,	Pittsburgh.
Rollin Germaine Hubby,	E.E.,	Cleveland, O.
Edward Blackstone Hurst,	C.E.,	Cincinnati, O.
William Lawall Jacoby,	M.E.,	South Bethlehem.
Alfred Emerson Jessup,	A.C.,	New York City, N. Y.
William Edward Johnson,	C.E.,	Glastonbury, Conn.
Arthur Bacon Jones,	E.M.,	Sewickley.
John Elmer Jones,	E.M.,	Hazleton.
Charles Lincoln Keller,	M.E.,	Dubuque, Iowa.
Henry Whitman Kern,	M.E.,	Chicago, Ill.
Robert Reed Kitchel,	M.E.,	South Bethlehem.
William Heath Kramer,	Clas.,	New Iberia, La.
Sylvester Welch Labrot,	C.E.,	Frankfort, Ky.

	COURSE.	RESIDENCE.
Herbert Gilfillan Lamberton,	C.E.,	Franklin.
Robert William Lawder,	E.M.,	Mexico, Mo.
George Edwin Lefevre,	A.C.,	Panama, U.S.Colombia.
Ellis Lewis,	A.C.,	Washington, D. C.
Alfred Emory Lister,	M.E.,	Carbondale.
William John Lloyd,	E.E.,	Philadelphia.
John Taylor Loomis,	E.E.,	Philadelphia.
Owen Francis Luckenbach,	M.E.,	Bethlehem.
George Hillard Lynch,	C.E.,	Wilkes-Barre.
James Alvan Macauley,	C.E.,	Washington, D. C.
William Ellicott Maccoun,	M.E.,	Baltimore, Md.
Henry Lewis Manley,	E.M.,	Ashland.
Edward Richard Martin,	C.E.,	Seaford, Del.
Raymond Masson,	E.E.,	Hammondsport, N. Y.
Archibald Stewart Maurice,	C.E.,	Athens.
Charles Watson Meade,	Clas.,	Cumberland, Md.
Victoriano Mendozo,	C.E.,	Gaudalajara, Mex.
Frank Anderson Merrick,	E.E.,	New Hope.
Edward James Millar,	C.E.,	West Broome, P.O., Can
Frederick Kent Morris,	Sci.,	Moorestown, N. J.
Charles Tyler Mosman,	E.E.,	Washington, D. C.
Frank Hamilton McCall,	M.E.,	Binghamton, N. Y.
Mathew McClung, jr.,	C.E.,	Knoxville, Tenn.
Joseph Ezekiel McDonald,	C.E.,	Washington, D. C.
John Cox McKean,	Sci.,	South Bethlehem.
Harvey Frankenfield Nase,	C.E.,	Springtown.
Robert Blum Olney,	C.E.,	Charleston, S. C.
Henry Orth, jr.,	E.M.,	Washington, D. C.
Ramon Eckhart Ozias,	C.E.,	Quakertown.
John Paret, jr.,	E.E.,	New York, N. Y.
William Taylor Patterson,	E.E.,	Mahanoy City.
Frank Everett Pratt,	C.E.,	Nicholson.

	Course.	Residence.
Joaquin Prieto,	M.E.,	Bogota, U. S. Colombia.
Thomas Clement Rafferty,	M.E.,	Chicago, Ill.
Enrique Alejandro Ramsden,	C.E.,	Santiago de Cuba.
Frank De Witt Randolph,	M.E.,	Plainfield, N. J.
Robert Swenk Rathbun,	C.E.,	Allentown.
Edgar Randolph Reets,	A.C.,	Wilkes-Barre.
Samuel Arthur Rhoads,	A.C.,	Birdsboro.
George William Ritchey.	L.S.,	Pittsburgh.
Edwin Gray Rust,	M.E.,	Leesburgh, Va.
Frank Schutte,	A.C.,	Philadelphia.
William Frederick Semper,	A.C.,	Philadelphia.
John Bonner Semple,	E.E.,	Pittsburgh.
Edward Hagan Shaw,	M.E.,	Philadelphia.
Cass Knight Shelby,	M.E.,	Grand Rapids, Mich.
Carroll Bradford Smith,	E.E.,	Norristown.
Clarence Galen Smith,	A.C.,	Cleveland, O.
Philip Henry Smith,	E.E.,	Parsippany, N. J.
Robert Jones Snyder,	M.E.,	Bethlehem.
Thomas George Spear,	C.E.,	Camden, N. J.
John Stewart,	E.M.,	Lonaconing, Md.
Frederick Elam Summers,	C.E.,	Washington, D. C.
Wilson Jones Taylor,	C.E.,	Edgmont.
Thomas Cedwyn Thomas,	C.E.,	Wilkes-Barre.
John Harry Tonkin,	C.E.,	Wilkes-Barre.
Lester Warren Walker,	E.E.,	North Platte, Neb.
Walker Wynne Wentworth,	E.E.,	Slatington.
Frank Parish Wilson,	E.M.,	Plainfield, N. J.
David Hykes Witmer,	C.E.,	Annville.
Frederic Wittman,	A.C.,	Lanark.
Charles Oaks Wood,	M.E.,	Chambersburg.
Byron Edgar Woodcock,	E.E.,	Altoona.

SPECIAL STUDENTS.

	COURSE.	RESIDENCE.
William Alexander Auchinvole,	A.C.,	Harrisburg.
Allen Harwood Babcock,	A.C.,	Oakland, Cal.
William Young Brady,	C.E.,	Franklin.
Albert Brodhead,	A.C.,	Bethlehem.
Charles Joseph Coll.	C.E.,	Broad Ford.
George Patterson Dravo, M.E.,	Met.,	Allegheny.
George Edmund Gay,	E.M.,	Pottsville.
Albert Edward Juhler,	A.C.,	Pomeroy, Ohio.
Harry Kinzer Landis,	E.M.,	Landis Valley.
Charles Douglass Mather,	M.E.,	Kincardine, Ont., Can.
Charles Wiltberger Platt,	A.C.,	New York, N. Y.
Alexander Potter,	C.E.,	Halifax, N. S.
Frank R. Reynolds,	A.C.,	Marietta, Ga.
Louis Augustus Round,	M.E.,	Providence, R. I.
Albert B. Rupp,	C.E.,	Mechanicsburg.
James Edward Strong,	E.M.,	England.
Samuel Dexter Warriner,	E.M.,	Montrose.
Frank Shriver West,	A.C.,	Philadelphia.
Edward Adam Wilhelm,	M.E.,	East Toledo. O.
Walter S. Winn,	C.E.,	Winchester, Ky.
Robert Jacob Yost,	A.C.,	South Bethlehem.
Roger Hanson Zimmerman,	E.M.,	Louisville, Ky.

SUMMARY OF STUDENTS BY STATES.

Vermont,	1
Massachusetts,	4
Connecticut,	3
Rhode Island,	3
New York,	30
Pennsylvania,	199
New Jersey,	23
Delaware,	1
Maryland,	9
District of Columbia,	24
Virginia,	4
West Virginia,	2
North Carolina,	2
South Carolina,	
Georgia,	6
Alabama,	1
Florida,	1
Louisiana,	2
Ohio,	12
Indiana,	3
Illinois,	5
Arkansas,	1
Wisconsin,	1
Minnesota,	2
Michigan,	1
Iowa,	1
Missouri,	3
Kentucky,	4
Tennessee,	3
Kansas,	1

Colorado,	2
California,	1
Oregon,	2
Nebraska,	2
Mexico,	1
New Mexico,	1
Nicaragua,	1
Nova Scotia,	1
Porto Rico,	1
Cuba,	4
Jamaica,	1
England,	1
Greece,	1
United States of Colombia,	4
Germany,	1
Canada,	2
Total,	383

SUMMARY OF STUDENTS BY CLASSES.

Graduates,	22
Seniors,	59
Juniors,	59
Sophomores,	99
Freshmen,	122
Specials,	22
Total,	383

SUMMARY OF STUDENTS BY COURSES.

SCHOOL OF GENERAL LITERATURE.

Classical Course,	22	
Latin-Scientific Course,	4	
Course in Science and Letters,	5	
		31

SCHOOL OF TECHNOLOGY.

Course in Civil Engineering,	124	
Course in Mechanical Engineering,	81	
Course in Mining Engineering,	61	
Course in Electrical Engineering,	41	
Course in Analytical Chemistry,	45	
		352
Total,		383

THE LEHIGH UNIVERSITY.

ORIGIN.

The Hon. ASA PACKER, of Mauch Chunk, during the year 1865, appropriated the sum of Five Hundred Thousand Dollars, to which he added one hundred and fifteen acres of land in South Bethlehem, to establish an educational Institution in the rich and beautiful Valley of the Lehigh. From this Foundation rose THE LEHIGH UNIVERSITY, incorporated by the Legislature of Pennsylvania in 1866. In addition to these gifts, made during his life-time, Judge Packer by his last will secured to the University an endowment of $1,500,000, and to the University Library one of $500,000.

DESIGN.

The original object of Judge Packer was to afford the young men of the Lehigh Valley a complete education, technical, literary and scientific for those professions represented in the development of the peculiar resources of the surrounding region. In furtherance of this purpose instruction is liberally provided in Civil, Mechanical, Mining and Electrical Engineering, Chemistry, Metallurgy, and in all needful collateral studies. A School of General Literature is also established and thoroughly equipped, with three departments called respectively, the Classical, the Latin-Scientific, and that of Science and Letters. These departments are kept up to the standard, and the requirement for entrance is the same as those of our best Classical and Literary institutions. A course in Architecture has also been ordered.

FREE TUITION.

All these educational facilities are provided without charge. Through the generosity of the Founder, the Trustees were enabled, in 1871, to declare tuition **FREE** in all branches and classes. The Lehigh University is open to young men of good character and suitable preparation from every part of our own land and of the world. To this fact the attention of the pupils of our public schools and of the graduates of classical institutions is especially called. Thus is offered, *without charge*, every facility for studying the professions of the Civil, Mechanical, Mining and Electrical Engineer, and of the Metallurgist and Analytical Chemist. In the Classical and Scientific departments of the School of General Literature instruction is given in the Classics, Sciences and Letters.

PUBLIC WORSHIP.

Prayers are held in the Packer Memorial Church of the University every morning and all students are required to be present.

Divine Service is held on every Sunday morning in the Church. The service is according to the forms of the Protestant Episcopal Church, under whose auspices the University was placed by its Founder. Attendance is required of every student, except in case of those connected with other religious bodies, to whom the President will grant permission at the beginning of each term (if requested by the parent or guardian, or by the student himself if he be 21 years of age) to attend during that term the place of worship of the body with which he is connected, where attendance on Sunday morning will be required.

SITE.

The situation of the Institution is healthful and beautiful. The region is famous for its railway and manufacturing enterprises; it possesses some of the richest iron and coal mines in our land, and thus gives the students rare facilities for confirming the teachings of the recitation room by the observation of the eye.

The University Buildings are about a half-mile from the depot, at the junction of the Lehigh Valley and North Pennsylvania Railroads. New York is ninety-two, and Philadelphia fifty-four miles distant.

BUILDINGS.

PACKER HALL,

named after the Founder, stands seven hundred feet back of Packer Avenue, at the base of the South Mountain. It is built of stone, and contains Lecture and Recitation Rooms, the Drawing Rooms and the Museum of Geology and Natural History.

THE CHEMICAL LABORATORY

is thoroughly fire-proof, is built of sandstone, and is 219 feet in length by 44 in width.

There are two principal stories and a basement. The upper floor is occupied by the quantitative and the qualitative chemical laboratories, the former accommodating 48 and the latter 84 students. These rooms are 20 feet in height, and are well lighted and ventilated. A laboratory for industrial chemistry and the supply room are also on this floor.

The first floor contains a large lecture room, a recitation room, a chemical museum and laboratories for organic, physiological, agricultural and sanitary Chemistry.

In the basement is the large laboratory for the furnace assay of ores and a well appointed laboratory for gas analysis, also rooms containing the apparatus for several processes in industrial chemistry, the engine and air-pump for vacuum filtration, a store room and the toilet.

A photographic laboratory is located in the third story of the central portion of the building.

THE METALLURGICAL LABORATORY

contains a lecture room, a blowpipe laboratory for class instruction in blowpipe analysis and in the practical determination of crystals and minerals, a museum for mineralogical and metallurgical collections, a mineralogical laboratory provided with a Fuess reflecting goniometer, a polariscope, a Groth's "universal apparat" and a Rosenbusch polarizing microscope, a dry laboratory provided with furnaces for solid fuel and for gas with natural draught and with blast, and a wet laboratory for ordinary analytical work. It is arranged for the instruction of classes in the courses of mineralogy, metallurgy and blowpipe analysis of the regular curriculum, and to afford facilities to a limited number of advanced students to familiarize themselves with the methods of measurement and research employed in mineralogy and metallurgy, and to conduct original investigations in these departments of science.

THE PHYSICAL LABORATORY

consists of three stories. A large lecture room with a seating capacity of 150, occupies a portion of the second and third floors. It is well lighted and adapted to its purposes. On the remainder of these floors are two rooms, each 40 feet long, for Heat and Light laboratories, a dark room for photographic work, spectroscopic and apparatus rooms and the private laboratories of the Instructors.

The lower floor is devoted to the use of the students in Electricity. A large room nearly 40 feet square is used as the Electrical Laboratory. There are smaller rooms for photometric and spectroscopic work, also reading, balance, apparatus and engine rooms. On this floor a 12 horse-power high speed engine and a dynamo supply two systems of electric lights, one of 25 incandescent lamps, the other of four arc lights, for practical tests in the Electrical Laboratory and for experimental purposes in the lecture room above. In the cellar are battery, store rooms, etc.

The tower and two rooms in the east end of Christmas Hall have been given to the Department of Physics and will be equipped as a Meteorological Observatory.

THE SAYRE OBSERVATORY.

Near Brodhead Avenue is the Sayre Observatory, the gift of Robert H. Sayre, Esq., of South Bethlehem, containing an equatorial and a zenith telescope, transit instrument and astronomical clock.

THE UNIVERSITY LIBRARY.

To the east of Packer Hall is the University Library, erected by the Founder in memory of Mrs. Lucy Packer Linderman, his daughter.

THE GYMNASIUM

is a handsome and spacious structure, built and equipped with the utmost thoroughness. It is furnished with the best patterns of gymnastic apparatus, besides Dr. Sargent's system of Developing Appliances. It is provided with hot and cold water; tub, sponge and shower baths, and 389 clothes closets. Opportunities for recreation and amusement are provided in the billiard room and bowling alleys. It is under the immediate care of a skilled and competent Director.

All students are required to undergo a physical examination before being allowed the use of the Gymnasium, and this examination will be repeated once each year during their stay at the University. The proper exercise is prescribed and is required of every student. The aim of the Institution is to promote a harmonious symmetrical development best suited to the individual condition of the student.

EXPENSES.

Tuition is FREE in all branches and classes. Books, materials, paper, pencils, chemical materials used in the analytical laboratory and drawing instruments, are furnished by the student.

Rooms and Board can not be had in University buildings, but can readily be obtained in many private houses.

The following is an estimate of the necessary expenses for the collegiate year, clothing and traveling not included :

Board for 40 weeks, . . .	from $160	to	$200
Room-rent, with fuel and lights .	40	"	80
Care of room and use of furniture,	5	"	20
Washing and incidentals, . . .	20	"	40
Books, stationery, etc., . . .	25	"	50
Total, ...	$250	to	$390

NOTE.—If clubs be formed the cost of board need not exceed $3.50 per week.

ADMISSION OF STUDENTS.

Application should be made to the President of the University, for all information concerning the admission of students. The Register is intended to give what is necessary.

DATE OF EXAMINATIONS.

Examinations for admission to the University are held at the opening of each term, and also in June at the close of the Academic year.

The examinations for 1889 will be on Tuesday and Wednesday, January 8 and 9, for admission to the *second term;* on Wednesday, Thursday and Friday, June 12, 13 and 14, and on Saturday, Monday, and Tuesday September 7, 9 and 10, for admission to the first term. No other examinations for entrance will be held, except for good cause, and all applicants *must* be in attendance at 8.30 on the morning of the first day.

The examinations are held in the following order:

First Day.—English Grammar, 9.00 A.M.; Geography, 11.30 A.M.; United States History, 2 P.M.; Physical Geography, 4 P.M.

Second Day.—Geometry, 9 A.M.; Arithmetic, 2 P.M.; Algebra, 3.30 P.M.

Third Day.—Latin and Roman History; Elementary Physics, 8.30 A.M.; Greek and Greek History, 2 P.M.

CHARACTER OF THE EXAMINATIONS.

The examinations are rigorous and cover the entire ground laid down in the following scheme. They are all conducted in writing, supplemented by an oral examination at the option of the examiner.

All candidates for admission must be at least sixteen years of age, must present testimonials of good moral character from their last Instructor, or from the School or Institute to which they last belonged, or from some reputable citizen of the community in which they live and, must satisfactorily pass in the following subjects :

1. *English Grammar*, including composition, spelling and punctuation. It is recommended that candidates have a knowledge of Latin Grammar, although an examination in it is not required for any courses except the Classical and the Latin-Scientific.

2. *Geography*, general and political.

3. *History of the United States*, including the *Constitution*.

4. *Arithmetic*, including the metric system of weights and measures.

5. *Algebra*, Fundamental Principles. Factoring. Least Common Multiple. Greatest Common Divisor. Fractions. Involution. Evolution. Radicals. Imaginary Quantities. Equations of the First and Second Degrees. Ratio. Proportion and Progressions.

[Olney's University Algebra is recommended, as it is the text-book used in the University.]

6. *Geometry*, Fundamental Principles. Rectilinear Figures. The Circle. Proportional Lines and Similar Figures. Comparison and Measurement of the Surfaces of Rectilinear Figures.

[Chauvenet's Geometry, (four books) is recommended, as it is the text-book used in the University.]

For admission to the various courses, *in addition* to the requirements above given, the examinations are as follows :

For all Courses except the Classical.

7. *Geometry*, Regular Polygons, Measurement of the Circle, Maxima and Minima of Plane Figures, and Plane and Polyhedral Angles; these constituting the subject matter of Books Five and Six of Chauvenet's Geometry.

8. *Elementary Physics*.

[Avery's Elements of Natural Philosophy (revised edition) is recommended.]

For the Latin-Scientific and Classical Courses.

9. *Physical Geography.*
10. *Latin Grammar*, (Harkness' preferred).
11. *Cæsar*, four books of the Gallic war.
12. *Cicero*, six orations, including the four against Catiline.
13. *Virgil*, the first six books of the Aeneid, including Prosody.
14. The translation, at sight, of passages from Cæsar and Cicero.
15. The translation of English into Latin. (As special importance is given this part of the examination, it is suggested to teachers that they connect exercises in making Latin, both oral and written, with all the studies of the preparatory course.)
16. *Roman History.* Creighton's Primer of Roman History is suggested as indicating the amount required.

For the Classical Course only.

17. *Greek Grammar*, (Hadley-Allen preferred).
18. *Xenophon*, Anabasis, four books.
19. *Homer*, Iliad, three books, including Prosody.
20. The translation, at sight, of a passage from some work of Xenophon.
21. *Greek History.* Fyffe's Primer of Greek History is suggested.
22. Writing Greek with accents.

The pronunciation of Greek according to the written accents is followed in the University, and it is desirable that students preparing to enter be taught this system.

Division of Entrance Examinations.

Candidates for admission to the Freshman Class may pass all the examinations *at once* in June, or in September, or may take them in *two consecutive years.* In the latter case for the Technical courses and the course in Science and Letters, candidates may present themselves for examination in the first year in the following subjects: English

Grammar, Geography, History of the United States, and Arithmetic. No credit will be given unless the candidate has passed satisfactorily in at least three subjects at one examination.

The examinations in Algebra, Geometry and Physics must be passed in June or September of that year in which the candidate proposes to enter the University.

In the Latin-Scientific and Classical courses candidates may present themselves for examination in the first year in the following subjects: English Grammar, History of the United States, Arithmetic, Physical Geography, and Roman History. No credit will be given unless the candidate has passed at least four of the subjects at one examination.

The examination in Latin may also be divided, but no credit will be given unless the candidate has passed in at least three of the topics specified at one examination. The examination in the remaining subjects must be passed in June or September of that year in which the candidate proposes to enter the University.

Candidates intending to enter the University in September are advised to present themselves for examination in June; if they are not fully prepared at that time they will receive credit for the examinations then satisfactorily passed.

CONDITIONAL ADMISSION.

A candidate failing to pass in one or more of the subjects required for admission may, at the discretion of the Faculty, be admitted to his class conditionally, to make up his deficiencies by extra study. When they are made up, he will be received into full standing in his class.

SPECIAL STUDENTS.

Young men who do not desire to take a full regular course can enter and select special shorter courses, with the sanction of the Faculty; but in all cases satisfactory examinations must be passed upon the subjects required for admission to the Freshman class.

ADMISSION TO ADVANCED STUDIES.

Candidates for admission to advanced studies *in any course* are required to pass, *in addition to the entrance examinations for that course*, examinations in the work already done by the classes which they desire to enter. These examinations are held on the same days as those for admission to the Freshman class.

The additional subjects may be found in the program of studies.

A diploma or, in so far as it covers the subjects required for admission, a certificate of studies taken at another College will be received in lieu of the *Primary Entrance Examinations only.*

ADMISSION TO THE POST GRADUATE COURSE.

Students of this University who have taken their *first* degree, and others, on presenting a diploma of an equivalent degree conferred elsewhere, are admitted to advanced studies, according to the plan to be found under the general subject of Graduate Students.

PREPARATORY SCHOOL CERTIFICATES

are not accepted so as to dispense with the primary entrance examination.

NOTE.—The acceptance of a certificate as evidence of proficiency in lieu of examination, is at the discretion of each Professor as to the subjects in his department.

PROGRAM OF STUDIES,

Showing the number of exercises per week for each subject, and the Text-books used.

The following is presented as the general program of instruction, subject to such modifications from time to time as the Faculty may deem expedient, with the approval of the Trustees.

The names of the text-books studied are generally mentioned. The number of exercises per week in each subject is indicated by the figure in parentheses immediately following.

Two hours of Drawing, three of work in the Laboratory, or three of practice in the field, are regarded as equivalent to a recitation or lecture of one hour's duration.

SCHOOL OF GENERAL LITERATURE.

This school is intended to correspond to the course long established in our older colleges, modified by the needs and requirements of modern culture. Its object is to impart a comprehensive and liberal education to those who design to enter upon professional rather than technical pursuits.

It comprises three distinct courses:

I.—The Classical Course or Course in Arts.
II.—The Latin-Scientific Course or Course in Philosophy.
III.—The Course in Science and Letters.

THE CLASSICAL COURSE.

This course is chiefly designed for those who purpose to study Law and Theology; it includes full and rigorous instruction in the Ancient Classics, in Elementary Science and in General Literature. The study of Mathematics in this course embraces Algebra, Geometry, Trigonometry, Analytical Geometry, and the Calculus. The program includes Physics, Chemistry and Elementary Mechanics. There are full courses in History, in the Science of Language and on the origin and growth of the English Language. There are also lectures on Psychology, Christian Evidences, International and Constitutional Law and Political Economy. Lectures on English Literature are supplemented by critical readings of the standard English authors. The graduate in this course obtains the degree of Bachelor of Arts (B.A.).

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet). (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

Greek.—Homer: Odyssey. Prosody. (3)

Latin.—Livy. Prose Composition. (2)

History.—History of Greece. (1)

Physiology and Health.—Lectures. (1)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic tables. (2)

Greek.—Xenophon: Oeconomicus. (3)

Latin.—Cicero: De Amicitia. Horace: Odes and Epodes. Composition and Prosody. (4)

History.—History of Greece. (2) History of Rome. (1)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry. Olney's General Geometry. (4)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Keetel's

Analytical Reader. (2) Or *German.*—Brandt's Grammar. Lodeman's Manual of Exercises. Joynes' Otto's Reader. (2)

Greek.—Herodotus. (2)

Latin.—Tacitus: Agricola and Germania. Composition. (2)

History.—History of Rome. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

**Mathematics*.— Differential and Integral Calculus: Olney. (4)

French.—Grammar and Reader (continued). (2) Or *German.*—Grammar, Exercises and Reader (continued). (2)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

History.—Weber's Outlines of Universal History. (2)

Greek.—Euripides: Medea. (3)

Latin.—Quintilian: Book X. Horace: Satires and Epistles. Composition. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and Lectures. (2)

Philosophy.—Coppée's Logic (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Reading. (2) Or *German.*—Grammar. Reading. (2)

Greek.—Sophocles: Electra. Antiquities. (3)

Latin.—Plautus and Terence. Roman Antiquities: Wilkins. (3)

Literature and History. (1)

Gymnasium. (2)

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* After the present year, Elective Courses in English, Greek, Latin, and other studies will be offered for those classical students who do not wish to pursue the study of the Calculus.

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Hill's Psychology. (2) Political Economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2) Or *German.* —Grammar. Reading. Dictation. (2)

Greek.—Aristophanes: Clouds. (3)

Latin. - Juvenal and Persius. Pliny: Select Epistles. Cruttwell's History of Roman Literature. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FISRT TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Haven's Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French.—Grammar. Saintsbury: Specimens of French Literature. Readings in Corneille, Racine, Molière, etc., and Contemporary authors. Compositions. Lectures on French Literature. (2) Or *German.*—Grammar. Readings in Lessing, Herder, Goethe, Schiller, etc., and Contemporary Authors. Compositions.. Lectures on German Literature. (2)

Conversation Class in both languages optional throughout the year.

Greek.—Pindar: Selected Odes. Greek Literature. (2)

Latin.—Lucretius, with Lectures. Roman Literature. (2)

Essays and Original Orations. (1)

Gymnasium. (2)

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

French.—Readings. Compositions. Lectures in French on Modern French Authors. (2) Or *German.*—Readings. Compositions. Lectures in German on Modern German Authors. (2)

Geology.—Lectures. Geikie. (2)

Greek.—Thucydides. Greek Literature completed. (2)

Latin.—Catullus; Tibullus and Propertius. Cicero: de Officiis, with Lectures. Roman Literature (completed). (2)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

THE LATIN-SCIENTIFIC COURSE.

The Latin-Scientific Course leading to the degree of Bachelor of Science (B.S.) is based on Latin without Greek.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry (Chauvenet completed). (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

German.—Joynes-Meissner's Grammar. Joynes-Otto's Reader. (3)

Latin.—Livy. Prose Composition. (2)

History.—History of Greece. (1)

Physiology and Health.—Lectures. (1)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of the Logarithmic Tables. (2)

German.—Grammar. Reader (continued). (3)

History.—History of Greece. (2) History of Rome. (1)

Latin.—Cicero: De Amicitia. Horace: Odes and Epodes. Composition and Prosody. (4)

English.—Exercises and Declamations. (1)

Gymnasium. (2.)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4.)

Physics.—Lectures. (3)

French.—Whitney's Practical French Grammar. Keetel's Analytical Reader. (2)

German.—Grammar. Reading. (2)

History.—History of Rome. (2)

Latin.—Tacitus: Agricola and Germania. Composition. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and Integral Calculus: Olney. (4)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Reader (continued). (2)

German.—Grammar. Reading. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Latin.—Quintilian: Book X. Horace: Satires and Epistles. Composition. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and Lectures. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Reading. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller and Contemporary Authors. Dictation. Compositions. (2)

Conversation Class in German optional throughout the year.

Latin. – Plautus and Terence. Roman Antiquities: Wilkins. (3)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy. — Hill's Psychology. (2) Political Economy. (1)

English. — Earle's Philology of the English Tongue. (2)

French. — Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2)

German. – Readings (continued). Dictation. Compositions. (2)

Latin. – Juvenal and Persius. Pliny: Select Epistles. Cruttwell's History of Roman Literature. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History. — Decline and Fall of the Roman Empire: Gibbon. (3)

Philosophy.—Haven's Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French. – Saintsbury: Specimens of French Literature. Readings in Corneille, Racine, Molière, etc., and Contemporary authors. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

Conversation Class in both languages optional throughout the year.

Latin.—Lucretius, with Lectures. Roman Literature. (2)

Essays and Original Orations. (1)

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

Geology.—Lectures. Geikie. (2)

Latin.—Catullus, Tibullus and Propertius. Cicero: de Officiis, with Lectures. Roman Literature (completed). (3)

French.—Readings (continued). Compositions. Lectures in French on Modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on Modern German authors. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

A COURSE IN SCIENCE AND LETTERS.

The Course in Science and Letters, leading to the Degree of Bachelor of Science (B.S.), is designed for those who wish to pursue both Scientific and Literary studies without Latin and Greek. These being omitted, extended instruction is given in French and German, History, General Literature, Mathematics and General Science.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Geometry, (Chauvenet) completed. (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

German. — Joynes-Meissner's Grammar. Joynes-Otto's Reader. (3)

Drawing.—Elementary Projections, Shading and Lettering. (2)

History.—History of Greece. (1)

Physiology and Health.—Lectures. (1)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of the Logarithmic Tables. (2)

Chemistry.—Qualitative Analysis. (3)

History.—History of Greece. (2) History of Rome. (1)

German.—Grammar. Reader (continued). (3)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

French.—Whitney's Practical French Grammar. Keetel's Analytical Reader. (2)

German.—Grammar. Readings. (2)

History.—History of Rome. (2)

English.—Exercises and Declamation. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

English.—Coppée's Rhetoric, with Kellogg's Praxis. (1)

French.—Grammar. Readings (continued). (2)

German.—Grammar. Readings. Dictation. (2)

History.—Weber's Outlines of Universal History. (2)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

History.—Wilhelm Müller's Political History of Recent Times, and Lecturers. (2)

Philosophy.—Coppée's Logic. (2)

English.—Coppée's English Literature. (4)

French.—Grammar. Readings. (2)

German.—Readings in Lessing, Herder, Goethe, Schiller and Contemporary authors. Dictation. Compositions. (2)

Conversation Class in German optional throughout the year.

Zoology.—Lectures and Laboratory work. Tenney. (2)

Crystallography.—Lectures, with Practical Exercises in the determination of Crystals. (2)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

History.—History of England: Hume. (3)

Philosophy.—Hill's Psychology. (2) Political Economy. (1)

English.—Earle's Philology of the English Tongue. (2)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Gasc's Translator. Dictation. (2)

German.—Readings (continued). Compositions. (2)

Mineralogy.—Descriptive Mineralogy, with practical exercises in the determination of Minerals. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

International Law.—Lectures: Woolsey. (2)

History.—Decline and Fall of the Roman Empire. (3)

Philosophy.—Haven's Moral Philosophy. (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

French.—Saintsbury: Specimens of French Literature. Readings in Corneille, Racine, Molière, etc., and Contemporary authors. Compositions. Lectures on French Literature. (2)

German.—Readings (continued). Compositions. Lectures on German Literature. (1)

In both languages, Conversation Class optional throughout the year.

Geology.—Williams' Lithology and Laboratory Practice. (2)

Essays and Original Orations. (1)

Gymnasium.

SECOND TERM.

Constitutional Law.—Lectures. (1)

History.—History of France. (2)

Philosophy.—History of Philosophy. (1) Philosophy of History. Lectures. (2)

Christian Evidences. (1)

French.—Readings (continued). Compositions. Lectures in French on Modern French authors. (2)

German.—Readings (continued). Compositions. Lectures in German on Modern German authors. (1)

Geology.—Historic, Dynamic and Economic Geology. Geikie. (2)

Lectures on American and English Literature. (2)

Preparation of Thesis.

Gymnasium.

THE SCHOOL OF TECHNOLOGY.

This School includes five distinct courses:

I. The Course in Civil Engineering.
II. The Course in Mechanical Engineering.
III. The Course in Mining and Metallurgy.
IV. The Course in Electrical Engineering.
V. The Course in Chemistry.

These have the same curriculum of studies for the first term of the Freshman year. At the end of that time the student selects his course and follows its program.

A course in Architecture, leading to the degree of Bachelor of Science, has been outlined, and the program of studies will appear in the Register for 1889–90. It will be parallel to the other courses in the school of Technology, and for the first year will be the same as the course in Civil Engineering.

FRESHMAN CLASS.

FIRST TERM.

Mathematics.—Chauvenet's Geometry (completed). (4)

Chemistry.—Lectures. Fownes' Elementary Chemistry. (4)

French.—Chardenal, First Course. Keetel's Analytical Reader. (3) Or *German.*—Joynes-Meissner's Grammar. Joynes-Otto's Reader. (3)

Drawing.—Free Hand Sketching. (2)

English.—Exercises and Declamations. (2)

Physiology and Health.—Lectures. (1)

Gymnasium. (2)

THE COURSE OF CIVIL ENGINEERING.

The special technical studies in this course may be grouped under the heads of Surveying, Applied Mechanics, Road and Railroad Construction, Bridge Design, and Hydraulic and Sanitary Engineering.

The work in Surveying extends over seven terms and embraces land surveying, leveling, topography, triangulation, railroad reconnaissance and location, hydrography, and the elements of geodesy. A large equipment of transits, levels and other surveying tools, affords students the opportunity of becoming familiar with the instruments of different manufacturers. Much time is devoted to practice in the field and drafting room, each student being required to become proficient in the use of instruments, in taking field notes, and in map drawing. Particular attention is paid to the execution of a secondary triangulation of a high order of precision, and to the execution of topographical surveys and maps by the best modern methods.

The work in Applied Mechanics comprises the strength and elasticity of materials, the theory of the equilibrium of arches, roofs and bridges, that part of the mechanics of machinery which relates to locomotives and hoisting machines, and the theory of hydraulics and hydraulic motors. Here the theoretical principles are illustrated by examples and problems taken as far as possible from actual engineering practice.

The course in Construction familiarizes the student with the qualities of materials used in engineering structures, with methods of preservation and testing, with masonry and foundations, and with the building and maintenance of roads and railroads. Plans, drawings, and estimates of cost are prepared for the construction of a line of railroad, all details, such as drains, culverts, road crossings, etc., being worked out by each student.

The course in Bridge Design starts with the study of full specifications for a first-class iron highway or railroad bridge. Each student then makes the full computations, designs, working drawings, and bills of material for the particular span assigned him. The weight of the designed bridge is finally determined and compared with the dead load assumed for the calculations. The drawings are made and dimensioned in the same manner as in the drafting office of a bridge company. In connection with this course, visits of inspection to bridges in the vicinity are regularly made.

The work in Hydraulic and Sanitary Engineering embraces the study of systems of water supply, the collection, purification and distribution of water, the combined and the separate systems of sewerage, the methods for the disposal of sewage, and the best practice for the drainage and ventilation of houses. The hydraulic laboratory in the University Park affords opportunity for experiments on the actual measurement of water by means of weirs and orifices, and the testing of hydraulic motors.

Besides these special studies there is a course in astronomy which includes practical work in the observatory. The study of English, and of French or German, is continued, and instruction is given during four terms in crystallography, mineralogy, lithology and geology.

The student who completes all the studies of this course will receive the degree of Civil Engineer (C.E.)

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Surveying.—Theory of Chain and Compass Surveying. Computation of Areas. Elements of Leveling. (1)

French.—Chardenal, Second Course. (Reader continued). (3) Or *German.*—Grammar and Reader (continued). (3)

Drawing. — Projection Drawing and Descriptive Geometry. Warren's Elementary Projection Drawing. (4)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat, and Electricity. Lectures. (5)

French.—Grammar. Reading. (2) Or *German.*—Grammar. Reading. (2)

Drawing.—Isometric Drawing. Architectural Drawing. (2)

Surveying.—Use of the Compass, Level and Transit. Surveys and Maps of Farms. Colored Topography. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics.—Differential and Integral Calculus: Olney and Courtenay. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Dictation. (2) Or *German.*—Grammar. Reading. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia and general equations of motion. (4)

Surveying.—Profiles and Contour Maps. Hydrographic and C ty Surveying. Use of the Plane Table. Topographical Drawing. (3)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus, and Wood's Analytical Mechanics. (2)

French.—Readings. Dictation. Compositions. (2) Or *German.*—Readings. Dictation. Compositions. (2)

Conversation Class in both languages optional throughout the year.

Surveying.—Triangulation. Leveling. Topographical Surveying with Transit and Stadia. Topographical Map. (4)

Strength of Materials.—Elasticity and Strength of Wood, Stone, and Metals. Theory of Columns, Shafts and Beams. Reports on the Testing of Materials. (4)

Construction. — Materials of Construction. Masonry. Foundations. Construction of Roads and Pavements. (2)

Crystallography.—Lectures, with practical exercises in the determination of Crystals. (2)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German*—Readings. Compositions. Lectures on German Literature. (2)

Surveying.—Theory of Railroad Curves. Railroad Reconnaissance and Location. Survey of a Line, with Profile, Map and Estimate of cost. (4)

Roofs and Bridges.—Theory and Calculation of Strains in Roof and Bridge Trusses. Graphical Statics. (3)

Construction.—Stone cutting, with practical Drawings. (2) Construction and Maintenance of Railroads. Theory of Retaining Walls and Stone Arches. (2)

Mineralogy.—Descriptive Mineralogy, with practical exercises in the Determination of Minerals. (3)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Astronomy.—Loomis' Treatise, with Lectures. (3)

Bridges.—Suspension, Continuous and Cantilever Bridges. Design of an Iron Bridge, with Working Drawings. (7)

Surveying.—Use of Solar Transit and Sextant. Precise Triangulation. Investigation of Systematic Errors of Instruments. (2)

Mechanics of Machinery.—Pile Drivers, Cranes, and Elevators. The mechanics of the Locomotive. (2)

Geology.—Williams' Lithology, with practical exercises in determining rocks. (2)

Gymnasium.

SECOND TERM.

Astronomy.—Doolittle's Practical Astronomy, with Observatory Work. (2)

Surveying—Elements of Geodesy. The Figure of the Earth. Map Projections. Elements of the Method of Least Squares. (2)

Hydraulics.—Hydrostatics. Efflux of water from orifices, and flow in pipes and rivers. Hydraulic motors. (2)

Hydraulic and Sanitary Engineering.—Collection, Purification and Distribution of Water. Systems of Water Supply. The Combined and the Separate System of Sewerage. Disposal of Sewage. House Drainage. Hydraulic Experiments. (5)

Geology.—Historic and dynamic. Geikie. (2)

Lectures on English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE OF MECHANICAL ENGINEERING.

The object of this course is the study of the Science of Machines; the principal subjects taught are: the nature, equivalence and analysis of mechanisms, the mechanics or theory of the principal classes or types of machinery, Mechanical Technology and the principles and practice of Machine Design.

That the students may obtain the practical engineering data which they will most need when beginning their work as mechanical engineers, they are required to pursue a course of Shop Instruction which does not necessarily involve manual labor and manipulation of tools, but is principally devoted to familiarizing them with those points in pattern-making, moulding, forging, fitting and finishing, which they need to know as designers of machinery Particular attention is therefore directed to the forms and sizes of machine parts that can be readily constructed in the various workshops, to the time that it takes to perform, and the order of, the various operations, to the dimensions most needed by workmen and to the various devices for increasing the accuracy of the work, durability of the parts and convenience of manipulation. This involves acquaintance with the processes and machinery of the workshops, but it is the foreman's and superintendent's knowledge which is required rather than the manual dexterity and skill of the workman and tool hand. The acquirements peculiar to the latter are by no means despised, and students are encouraged to familiarize themselves therewith during leisure hours, but manual work in the shops forms no regular part of the course. On the contrary, the student enters the shop with hands and mind free to examine all the processes, operations and machinery, and is ready at the call of the teacher, to witness any operation of special interest. Provided with note-book, pencil, calipers and measuring rule, the student sketches the important parts of the various machine-tools, notes down the successive steps of each of the important shop-processes as illustrated by the pieces operated upon, and follows pieces of work through the shops from the pig or merchant form to the finished machine.

That the students may learn to observe carefully and be trained to think and observe for themselves in these matters, there is required of them a full description of the various processes, operations and tools involved in the production of each one of a series of properly graded examples of patterns, castings, forgings and finished pieces which are not being constructed in the shops at the time and the blue prints for which have been given to them on entering the shops. The student's work is directed not only by these drawings and by the printed program given him at the start, but also personally by a teacher, who accompanies him into the shops, gives necessary explanations, and tests the extent and accuracy of his knowledge by examining the sketches and notes and by frequent questioning. Finally the results of the observations and the sketches are embodied in a memoir.

During the course there are frequent visits of inspection to the Bethlehem Iron Co., the L. V. R. R. Shops at Easton, and other engineering works both in and out of town, with special reference to such subjects as Machine Elements, Prime Movers, Machinery for lifting, handling and transporting, and Machinery for changing the form and size of materials. It is intended that each of these excursions shall have some definite purpose in view which must be fully reported by the students. These visits are also made the occasion for constant practice in the Free Hand Sketching of Machinery.

The instruction in Machine Design begins with second term of the Freshman year and is continued throughout the course. At first tracings of good examples of machine drawings are made; then there is considerable drill in the interpretation of such drawings and general views of lathes, planers, drills and shapers are made from the drawings of the details. This is followed by difficult projections and intersections and exercises in the empirical proportioning of machine parts. Both empirical and rational formulas are used to determine the dimensions of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods, the data being given as they would arise in practice and the drawings made full size. During the Junior year the class takes up the design of a high speed steam engine, every dimension being determined by the students and complete drawings made. During the Senior year the students undertake the calculations, estimates and working drawings involved in the design of a simple but complete machine, each student being engaged upon a different machine. From the finished drawings of each machine, tracings are made and then blue prints taken for distribution among the other members of the class. In the case of the machines and of the engine, the general plan or arrangement will be given to the students in the form of rough sketches, photographs or wood-cuts. In the last term the students are expected to make original designs for simple machinery, whose object has been fully explained. Throughout the course the work in the draughting room is carried on as nearly as possible like that of an engineering establishment, and special attention is paid to methods of expediting the work of calculation by means of simple formulas, tables and diagrams.

The graduate in this course will receive the degree of Mechanical Engineer (M.E.).

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

French.—Chardenal, Second Course. Reader (continued). (3) Or *German.*—Grammar and Reader (continued). (3)

Machine Design.—Tracings. Interpretation of machine drawings by isometric sketches. General views from given details. Sections of stub ends and valve passages. Intersection of boiler flues. Empirical proportioning of machine parts. (5)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

Machine Design.—Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods. (2)

Visits of Inspection.—Examination and sketching of principal machine parts in the shops of the vicinity. (2)

French.—Grammar. Reading. (2) Or *German.*—Grammar. Reading. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney and Courtenay. (4)

Physics.—Sound, Light and Meteorology. Lectures. (3)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Dictation. (2) Or *German.* — Grammar. Reading. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia and general equations of motion. (4)

Steam Engine.—Rigg's Practical Treatise. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Readings. Dictation. Compositions. (2) Or *German.*—Readings. Dictation. Compositions. (2)

Conversation Class in both languages optional throughout the year.

Mechanical Technology.—Shop instruction. Examination of the processes and appliances involved in pattern making, moulding, forging, fitting and finishing, with sketches and reports. (7)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, shafts and columns. Reports on experimental tests. (4)

Literature and History. (1)

Gymnasium. (2)

SECOND TERM.

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.* — Readings. Compositions. Lectures on German Literature. (2)

Kinematics of Machinery. Reuleaux. Nature and Equivalence of Mechanisms. (3)

Machine Design. Calculations and Working Drawings for a High Speed Steam Engine. (5)

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

Machinery of Transmission.—Weisbach-Herrmann. (2)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to Steam Engines and Air Compressors. (3)

Graphical Statics.—Graphical Analysis of Roof Trusses and Girders. (2)

Machine Design.—Calculations and working drawings for hoisting, pumping and metal-working machinery. (4)

Kinematics.—Diagrams of the changes of position, speed and acceleration in mechanisms. Link and valve motions. Quick return motions. Parallel motions. Laying out of Cams. (3)

Mechanics of Machinery.—Weisbach-Herrmann. Hoisting Machinery, Accumulators, Cranes and Locomotives. (4)

Gymnasium.

SECOND TERM.

Mechanics of Machinery.—Weisbach-Herrmann. Pumps, Pumping Engines, Blowing Engines, Compressors and Fans. (4)

Machine Design. – Original Designs. (5)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels ; hydraulic motors. (2)

Measurement of Power. – Indicating of Steam Engines; determination of evaporative efficiency of boilers ; dynamometer experiments. (1)

Lectures on American and English Literature. (2)

Christian Evidences. – Lectures. (1)

Preparation of Thesis.

Gymnasium.

THE COURSE IN MINING AND METALLURGY.

This course aims to fit the student for practical work in either of the branches of Mining, Metallurgy, Metallurgical Chemistry, or Geology. On account of the great number and scope of the studies necessary to the completion of this course, it is five years in length. At the completion of the fourth year the student will have completed a course similar to that leading to the Scientific degree in other institutions and will receive the degree of Bachelor of Science in Mining and Metallurgy (B.S).

The graduate in this course will receive the degree of Engineer of Mines (E.M.), which includes that of Metallurgist.

CHEMISTRY.—The course in Theoretical and Applied Chemistry extends over three years and includes the methods of wet and dry Assaying and Blowpipe analysis combined with the working of Stoichiometric problems and the Study of Chemical Philosophy. The practical work is that required for a Metallurgical Chemist or Assayer.

With moderate care the expenses in this department need not exceed $120.

METALLURGY.—This course extends over one year and, after treating of the principles of the subject, enters minutely into the processes for the extraction and separation of metals from ores, with details of the necessary plants required and costs of extraction. A special laboratory attached to this department affords practical work in metallurgical problems.

GEOLOGY.—Three terms are devoted to Crystallography, Mineralogy, and Macroscopic Lithology. In each study, after a grounding of the theory of the subject, there is an extended course in practical determination of the most important species. There are from three to four hundred specimens to illustrate the first study and from three to five thousand hand specimens for each of the two latter. A year is then given to dynamic, historic and economic Geology, and this is supplemented by field work and the construction of maps and sections.

ASTRONOMY.—After studying the theory of the subject, two thirds of the year are devoted to practical work in the Observatory.

APPLIED MECHANICS.—This embraces Hydraulics, a study of the Steam Engine and the mechanics of machines employed in Mining and Metallurgy.

SURVEYING.—A course extending over five terms offers practice in land, mine, and geological surveying, leveling, topography, triangulation, and railroad reconnaissance and location. It also includes practical work in drawing and map construction.

MINING.—This course covers the theory and practice of locating and winning deposits with a full discussion of and practice in the engineering problems occurring in Mining, such as haulage, pumping, ventilation and hygiene, ore-dressing, and mining Law. A series of projects supplement the problems and give practical studies in Mining and Metallurgy.

The location of the University in the vicinity of the iron works of the Lehigh Valley and especially of the extensive establishment of the Bethlehem Iron Company, affords unusual facilities for the practical study of iron metallurgy. The processes for the manufacture of spelter and oxide of zinc may be studied at the Bethlehem Zinc Works. The facilities for the practical study of mining and economic geology are not excelled by those of any other Institution in the country. The zinc mines at Friedensville and the brown hematite and slate deposits of the Lehigh Valley are in the immediate vicinity, while within easy reach by rail are the anthracite coal fields of Pennsylvania, the iron and zinc mines of New Jersey, and the celebrated iron mines at Cornwall, Pa.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Pt. III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic tables. (2)

French.—Chardenal, Second Course. Reader (continued). (3) Or *German.*—Grammar and Reader (continued). (3)

Drawing. — Projection Drawing and Descriptive Geometry. Warren's Elementary Projection Drawing. (4)

Surveying.—Theory of Chain and Compass Surveying. Computation of Areas and Leveling. (1)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

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SOPHOMORE CLASS.

FIRST TERM.

Mathematics. — Analytical Geometry: Olney's General Geometry. (4)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

French. –Grammar. Reading. (2) Or *German.*—Grammar. Reading. (2)

Drawing. — Isometric Drawing. Architectural Drawing. (2)

Surveying.—Use of the Level and Transit. Surveys and Maps of Farms. Colored Topography. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney and Courtenay. (4)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia and general equations of motion. (4)

Chemistry.—Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (4)

Stoichiometry. (2)

French.—Grammar. O'Connor: Choix deContes Contemperains. Dictation. (2) Or *German.*—Grammar. Reading. Dictation. (2)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics. –Courtenay's Calculus and Wood's Analytical Mechanics. (2)

Strength of Materials. —Elasticity and strength of wood, stone and metals. Theory of beams, columns and shafts. (4)

Crystallography. — Lectures, with Practical Exercises in the determination of Crystals. (2)

Surveying. — Triangulation. Leveling. Topographical Surveys with Transit and Stadia. Topographical Maps. (4)

Chemical Philosophy. — Cooke. (3)

French.—Readings. Dictation. Compositions. (2) Or *German.*—Readings. Dictation. Compositions. (2)

Conversation Class in both languages optional throughout the year.

Literature and History.

Gymnasium. (2)

SECOND TERM.

Mineralogy. — Descriptive Mineralogy, with Practical Exercises in the Determination of Minerals: E. S. Dana. (3)

Blow-Pipe Analysis.—Lectures, with Practice. Plattner, Brush, or Nason and Chandler. (1)

Chemistry.—Fresenius' Quantitative Analysis. (3) The following analyses are executed by the student:

1. Iron Wire (Fe)
2. Copper Ore (Cu)
3. Silver Coin (Au, Ag, Pb, Cu)
4. Zinc Ore (Zn) By both Gravimetric and Volumetric Methods.
5. Bronze (Cu, Sn, Zn, Pb)
6. Spiegeleisen (Mn)
7. Lead Ore (PbS)
8. Ilmenite (TiO_2)
9. Iron Ore (Complete Analysis)

Steam Engine.—Rigg's Practical Treatise. (3)

Surveying.—Theory of Railroad curves. Railroad Reconnaissance and Location. Survey of a Line, with Profile, Map and Estimate of cost. (4)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German Literature. (2)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Thermodynamics.—General principles; application to Steam Engines and Air Compressors. (3)

Geology.—General Geological Definitions and Principles. Dynamic Geology. Dana. (2)

Lithology.—Williams' Lithology, with practical exercises in determining rocks. (3)

Chemistry.—Quantitative Analysis: Laboratory Work: Fresenius. (5) The following analyses are executed by the student:

10. Limestone (Complete Analysis)
11. Coal (Volatile Matter, Fixed Carbon, Ash, H_2O, S, P)
12. Slag (Complete Analysis)
13. Pig Iron (Complete Analysis)
14. Carbon in Steel (Volumetric)
15. Nickel Ore (Ni, Co)
16. Gas Analysis.

Assaying.—Including the Assay by the dry methods of Gold, Silver, Antimony, Mercury, Lead, Iron and Tin ores. Laboratory Work. Ricketts. (3)

SECOND TERM.

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

Mining.—Modes of Occurrences of the Useful Minerals. Searching for Mineral deposits. Examination of Mining Properties. Boring. Mining Tools, Machines and Processes. Timbering and Masonry. Callon. André. Lectures. (3)

Geology.—Historic and Economic Geology. Lectures. Dana. (4)

Blow-pipe Analysis.—Practice. (1)

Hydraulics.—Hydrostatics. Flow of water in pipes and channels. Hydraulic motors. (2)

Surveying.—Mine Survey. Theory and Practice, with construction of Mine Maps. Tunneling and Shaft location. (2)

Gymnasium.

POST-SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of Copper, Lead, Silver, Gold, Platinum, Mercury, Tin, Zinc, Nickel, Cobalt, Arsenic, Antimony and Bismuth. (5)

Mining.—Methods of Working. Underground Transportation. Hoisting, Drainage and Pumping. Ventilation and Lighting. Hygiene of Mines. (4)

* *Mechanics of Machinery.*—Weisbach-Herrmann. Hoisting Machinery, Accumulators, Cranes. (2)

Astronomy.—Descriptive Astronomy: Loomis. (3)

* *Surveying.*—Geological Survey: Mapping and cross-sectioning. (2)

SECOND TERM.

Mining.—Mechanical Preparation of Ores. Coal Washing. (2)

Mechanics of Machinery.—Pumps, Pumping-Engines, Blowing-Engines, Compressors and Fans. (4)

Astronomy.—Doolittle's Practical Astronomy, with Observatory Work. (2)

Drawing.—Mining Plant. Systems of Timbering. (3)

Projects.—In Mining, Geology and Metallurgy. (2)

Lectures on American and English Literature. (2)

Christian Evidences.—Lectures. (1)

Preparation of Thesis.

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* The Surveying is completed in the first half of the term by taking four exercises per week. The Mechanics of Machinery is then begun.

THE COURSE IN PHYSICS AND ELECTRICAL ENGINEERING.

In the arrangement of the details of this new course, the object has been to provide for those, who seek to fit themselves as Electrical Engineers, a preliminary training as complete and broad as that given to the members of the other schools. The requirements for admission, the mathematical and English studies, the modern languages and other outside branches are the same as those in the other technical courses. To these have been added such portions of the Mechanical Engineering Course, with which this course is most closely allied, as are necessary to give the student a general, but sufficiently accurate knowledge of machinery.

This preparation joined to the unusually full development of Physics — and especially of Electricity — will, it is thought, make a course sufficiently comprehensive and thorough for the proper training of candidates for this degree. The great success attending the large majority of the young men who have taken the one year's Course in Electricity, in their subsequent electrical work, warrants the belief that this broader and more extended course will attain its object.

The main feature of this new course is the prominence given to the subject of Physics. This extends through three years and while Electricity is specially developed, the other branches, Elementary Mechanics, Heat and Light are fully provided for. The opportunity is thus given to any one, who wishes to acquire a more extensive knowledge of Physics than the University curriculum has heretofore offered. The student is well drilled in the theory by means of lectures and recitations, which carefully cover the whole subject and he is required to go over the ground himself in the best of all schools—the working laboratory. Enough of work on each topic is given him to render him familiar with his subject. Much prominence is given to work that brings out the resources of the student himself, such as the construction of instruments and original investigation. He is encouraged to this and a regular portion of his time is set apart for this object.

It will be seen from the preceding statement that this course offers two great advantages; the thorough and extensive training of those intending to take parts in the great development of Electric Science in the industrial field now going on and the facilities offered to those who wish to take a four years' course specially devoted to the whole branch of Physics.

The degree of Electrical Engineer (E.E.) will be given to the graduates of this course.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Chemistry.—Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (2)

French.—Chardenal, Second Course. Reader (continued). (3) Or *German.*—Grammar and Reader (continued). (3)

Drawing.—Projection Drawing and Descriptive Geometry. Warren's Elementary Projection Drawing. (3)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Mathematics.—Analytical Geometry: Olney's General Geometry. (4)

Mechanics, Sound and Heat.—(Theory, lectures and recitations.) (3)

Mechanics.—(Physical Laboratory). Exact Measurements. Density. Elasticity. Tenacity. Hydrostatics. Specific Gravity. Atmospheric Pressure (with barometric leveling.) Gravitation. Moments of Inertia.

Sound.—Determination of velocities and wave lengths. Measurements of vibrations. Verifications of laws of vibrations of sounding bodies.

Heat.—Construction of Instruments. Thermometry. Expansion. Conduction. Radiation. (4)

Drawing.—Isometrical Drawing. Architectural Drawing. (2)

French —Grammar. Reading. Or *German.*—Grammar. Reading. (2)

English.– Exercises and Declamations. (1)

Gymnasium. (2)

SECOND TERM.

Mathematics. — Differential and Integral Calculus: Olney and Courtenay. (4)

Heat.—Continued. (Physical Laboratory.) Fusion and Vaporization. Calorimetry. Hygrometry. Elementary Thermodynamics. (3)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Dictation. (2) Or *German.* — Grammar. Reading. Dictation. (2)

Mechanics.—Theory of motion, statics, energy, center of gravity, moment of inertia and general equations of motion. (4)

Steam Engine.—Rigg's Practical Treatise. (3)

Essays and Declamations.

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Mathematics.—Courtenay's Calculus and Wood's Analytical Mechanics. (2)

French.—Readings. Dictation. Compositions. (2) Or *German.*—Readings. Dictation. Compositions. (2)

Conversation Class in both languages optional throughout the year.

Light and Magnetism.—(Theory ; text-books and lectures.) (3)

Light.—(Physical Laboratory). Investigation of general Principles and Laws. Determination of Focal Lengths and Indices of Refraction, Testing and Adjustment of Optical Instruments. Spectroscopic Analysis. Photometry. Polarization. Diffraction.

Magnetism.—Fundamental Experiments. Verification of Laws of Magnets. Study and Mapping of Lines of Force. Determination of Moments of Magnets ; and of horizontal component and whole intensity of Earth's Magnetism in absolute units. Distribution of Magnetism. (3)

Meteorology.—Text-book and practice. Observations for several months as taken in the U. S. Signal Service stations ; with all the usual corrections and reductions ; construction of charts ; mapping curves ; reports etc. (1)

Strength of Materials.—Elasticity and strength of wood, stone and metals. Theory of beams, columns and shafts. (4)

Boilers.—Wilson. Strength, construction and wear and tear of boilers. (1)

English.—Exercises and Declamations.

Gymnasium. (2)

SECOND TERM.

Electricity.—Theory ; text-books and lectures. (3)

Static Electricity.—(Physical Laboratory). Investigation of Principles. Quantitative Laws. Measurements of Potential, Capacity, etc. Induction. Condensation. Analysis of Machines.

Voltaic Electricity.—Management and care of a large variety of batteries. Construction of Instruments. Determination of Constants. Electro-Magnetism. Induction. Electro-Dynamics. Electrical Measurements of Potential, Resistance and Current Strength. Electrolysis. Electroplating. Electrotyping. Thermo-Electricity. Secondary Batteries. Relation of Electrical Currents to Heat and Mechanical Work. (5)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.* — Readings. Compositions. Lectures on German Literature. (2)

Machine Design.—Calculations for a High Speed Steam Engine. Proportioning of such machine parts as come under the head of fastenings, bearings, rotating and sliding pieces, belt and toothed gearing, levers and connecting rods. (5)

Literature and History.—Lectures. (1)

Essays and Original Orations.

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Dynamic Machines.—Theory, text-book and lectures. (2) (Physical Laboratory). Practical running and care of dynamos and motors. Measurements of magnetic field, potential, resistance and heating. Visits to manufactories and working systems. (2)

Electric Lighting.—Lectures. (2) (Physical Laboratory). Study of different systems. Calculations and arrangement of plant. Wiring. Insulation. Photometric tests of different arc and incandescent lamps. Determination of heat units given off by various incandescent lamps; their resistance (hot and cold). Energy consumed in lamps and conductors. Spectroscopic tests of purity of carbons. (3).

Machine Design.—Proportioning of Machine Parts (continued). (2)

Astronomy.—Loomis' Treatise, with Lectures. (3)

Graphical Statics of Mechanism.—Herrmann—Smith. (2)

Scientific Readings.

Gymnasium.

SECOND TERM.

Telegraphs and Telephone.—Investigation of different systems. Arrangement of lines and stations. Test of lines for conductivity, insulation, location of faults etc. (2)

Application of Electricity to Railways.—Theory of the two systems, with inspection of electric railways. (1)

Measurement of Power.—Indicating of Steam Engines; dynamometer experiments. (1)

Dynamic Machines.—(Physical Laboratory). Tests of Efficiency in Generators and Motors etc. (1)

Physics.—Original Investigation. (5)

English Literature.—Lectures on English and American Literature. (2)

Christian Evidences. (1)

Preparation of Thesis.—(With laboratory work).

Gymnasium.

THE COURSE IN CHEMISTRY.

This course of study is designed to prepare students for the profession of the Chemist, in connection with metallurgical establishments, sugar refineries, gas works, superphosphate works, electrical machinery manufactories, mining companies, etc., and the general consulting and analytical work of the Professional Chemist. It is also well adapted for the preparation of teachers of chemistry and as a preliminary course to the study of medicine. It is eminently practical, the student's time being largely occupied by practical work in the large, well equipped and well ventilated chemical laboratories, which were completed in 1885 and constitute the best contructed building for this purpose in this country. The museum of Chemistry contains large collections of specimens, for illustrating the lectures on theoretical and applied Chemistry.

Theoretical Chemistry.—Instruction in this subject begins with lectures four times a week, in the first term of the Freshman year; these lectures are fully illustrated by experiments, colored diagrams, working drawings and lantern pictures and specimens from the museum. They include a general introduction to Theoretical Chemistry and a description of the non-metallic and metallic elements and their compounds, the general subject of inorganic chemistry. The students are required to take notes of the lectures, and to pass a written examination at the end of the term.

In the second term of this year Stoichiometry and chemical problems and reactions are taught by recitations twice each week.

The study of Theoretical Chemistry is continued throughout the Sophomore year, by recitations three times a week from Cooke's Chemical Philosophy and is concluded in the first term of Junior, by a course of lectures and recitations on Theoretical Organic Chemistry, four times a week. These lectures are illustrated by experiments and by specimens from the museum of Chemistry.

Written examinations are held at the close of each of the above courses.

ANALYTICAL CHEMISTRY. — Qualitative Analysis is taught in the second term of the Freshman year, by lectures, recitations and practical work in the Qualitative Laboratory, twelve hours of practical work per week being required. This laboratory is a large, well ventilated and well lighted room, and supplied with convenient working tables, vacuum filtration, hoods for noxious vapors, steam baths, gas and washing appliances and a commodious room for hydrosulphuric acid. Distilled water is delivered by faucet in this room and the other large laboratories. At the close of the term a practical examination is held in this subject.

After completing this course, Quantitative Analysis is taken up throughout the Sophomore and the first term of the Junior years. This subject is taught by lectures, recitations and practical work in the Quantitative Laboratory, which is equipped similarly to the Qualitative Laboratory, but is supplied in addition with apparatus for drying precipitates and residues, rooms for the chemical balances, for combustions, and for a reference library.

Twelve hours per week are required during the first term of the Sophomore year and fifteen hours during the second term of that year and the first term of the Junior year.

The course consists in Gravimetric and Volumetric Analyses, as applied to the substances given in the lists farther on, accuracy being required in the determination of each constituent.

At the close of each term, written examinations are held upon the theory and practice of Quantitative Analysis.

GAS ANALYSIS is taught by lectures and laboratory practice in the Gas Laboratory. This laboratory is supplied with full and complete apparatus for Gas Analysis, according to Bunsen's processes, as well as apparatus for some of the more rapid methods. Mixtures of gases are required to be analyzed by the students, within certain limits of error, and a written examination, on the theory and practice, is held at the close of the course.

ASSAYING.—The Assaying of ores by furnace assay, together with gold and silver bullion analysis, by processes practiced in the United States Mint, is taught by lectures and practical work in the first term of the Junior year, nine hours of practical work per week being required. The course includes the assaying of ores of lead, tin, antimony, gold, silver and iron, coal, and gold and silver bullion.

The Assaying Laboratory is supplied with large working tables, twenty-nine crucible and two iron furnaces, and eight muffle furnaces, with adjoining rooms for balances, and gold and silver bullion analysis.

A certain accuracy of results and a written examination as regards the theory and practice are required.

ORGANIC CHEMISTRY.—The practical work in this subject is performed in the second term of the Junior and first term of the Senior years, fifteen hours during the former and twelve hours during the latter term being required, with conferences and recitations each week. The laboratory for this work is equipped similarly to the Quantitative Laboratory, in addition being supplied with steam heat, cold water and air blast upon the working tables, and a full supply of apparatus for the various determinations and experiments, including combustion furnaces, furnaces for heating sealed tubes, mercury pump, Hoffman's, Dumas' and Meyers' apparatus for vapor densities, nitrometers, chemical balances, etc.

The course consists of determinations of specific gravities, melting points, boiling points, vapor densities, chlorine, bromine, iodine and sulphur of organic substances.

Combustion analysis, nitrogen determination, fractional distillation, and the preparation of several pure organic compounds and their analysis are included.

Industrial Chemistry. — A course of lectures is delivered upon this subject in the second term of the Senior year, illustrated by experiments, diagrams, lantern pictures and specimens from the museum of Chemistry. The working laboratory for this subject contains an apparatus for making illuminating gas, an alcohol still, worm and doubler and a complete working model of a sugar refinery, including filters, vacuum pan and centrifugal. In connection with this laboratory is a room containing a photometer and apparatus for determining the sulphur, ammonia and specific gravity of illuminating gas ; also a laboratory for the testing of alcoholic liquors, sugar, molasses, bone black, soap, petroleum, paints, dyes, superphosphates and other commercial products, with the necessary technical apparatus. The students make practical experiments in this direction, and, with an instructor, visit various industrial establishments in this neighborhood and in and around New York City.

Toxicology.— A course of lectures on this subject is given in the first term of the Junior year, illustrated by experiments and by the large collection of specimens of poisons from the museum of chemistry. This is supplemented by a short course of laboratory work on some of the common poisons.

SANITARY CHEMISTRY. — During the second term of the Senior year, attention is given to the qualitative and quantitative examination of air, water, food, disinfectants, and other subjects connected with this branch of the science. Special apparatus is provided for this work, as recommended by the best authorities on the subject.

PHOTOGRAPHIC CHEMISTRY. — Well equipped Photographic Laboratory and dark rooms are provided, in which the students of the chemical course receive practical instruction.

PHYSIOLOGICAL CHEMISTRY. — The examination of urine, blood, etc., receives a proper amount of attention.

The course also includes instruction in physics, mineralogy, blowpipe analysis, metallurgy and geology, which are of great value to the chemist.

In the last term of the Senior year, the student is required to prepare a Thesis on some subject, selected by the Professor of Chemistry, involving practical work in the laboratory in addition to the literary labor, each graduate thus making a contribution to the progress of the science, as a preliminary to the reception of his degree.

The graduate of this course receives the degree of Analytical Chemist. (A.C.)

Students, not candidates for a degree, are admitted for special courses in chemistry, of which they receive certificates.

The Laboratories are under the immediate charge of the Professor and Instructors of Chemistry and are open to the students from 8 o'clock, A.M., to 6 o'clock, P. M., including Saturdays. Students are at liberty to work in the Laboratories, beyond the required hours, as their time may permit. Students are charged for materials and apparatus consumed; with moderate care this expense need not exceed $50 per year.

FRESHMAN CLASS.

SECOND TERM.

Mathematics.—Olney's University Algebra, Part III. (3) Plane and Spherical Trigonometry and Mensuration. Use of Logarithmic Tables. (2)

Chemistry.—Lectures and Laboratory Practice. Douglass and Prescott's Qualitative Analysis. (4)

French.—Chardenal, Second Course. Reader (continued). (3) Or *German.*—Grammar and Reader (continued). (3)

Stoichiometry. (2)

English.—Exercises and Declamations. (2)

Gymnasium. (2)

SOPHOMORE CLASS.

FIRST TERM.

Chemical Philosophy.—Cooke. (3)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (4)

The following analyses are executed by the student:

1. Iron Wire (Fe)
2. Potassium Dichromate (Cr_2O_3)
3. Barium Chloride (Ba, Cl, H_2O)
4. Magnesium Sulphate (MgO, SO_3, H_2O)
5. Disodium Hydrogen Phosphate (P_2O_5)
6. Rochelle Salt (K_2O, Na_2O)
7. Volumetric Determination of Chlorine.
8. Acidimetry (HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$)
9. Alkalimetry (KOH, NaOH, NH_4OH, Soda Ash, Pearl Ash)
10. Chlorimetry (Bleaching Powders)

Quantitative Analysis—Conference. (1)

Physics.—Mechanics, Heat and Electricity. Lectures. (5)

French.—Grammar. Reading. (2) Or *German.*—Grammar. Reading. (2)

English.—Exercises and Declamations. (1)

Gymnasium. (2).

SECOND TERM.

Physics.—Sound, Light and Meteorology. Lectures. (3)

French.—Grammar. O'Connor: Choix de Contes Contemporains. Dictation. (2) Or *German.*—Grammar. Reading. Dictation. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

11. Copper Ore (Cu)
12. Zinc Ore (Zn). By both Gravimetric and Volumetric Methods.
13. Lead Ore (Pb, S)
14. Silver Coin (Au, Pb, Ag, Cu)
15. Spiegeleisen (Mn)
16. Copper Alloys. (Complete Analysis.)
17. Ilmenite (TiO_2)
18. Iron Ore (Complete Analysis)
19. Limestone (Complete Analysis)
20. Coal (Volatile Matter, Fixed Carbon, Ash, H_2O, S, P)
21. Slag (Complete Analysis)

Quantitative Analysis.—Conference. (1)

Blow-Pipe Analysis.—Lectures, with Practice. Plattner, Brush, or Nason and Chandler. (1)

Chemical Philosophy. (3)

Essays and Declamations. (1)

Gymnasium. (2)

JUNIOR CLASS.

FIRST TERM.

Toxicology.—Lectures. (2)

Quantitative Analysis.—Fresenius' Quantitative Analysis. (5)

The following analyses are executed by the student:

22. Guano (NH_3, P_2O_5, H_2O)
23. Clay (Complete Analysis)
24. Manganese Ore (MnO_2)

25. Mineral Water (Complete Analysis)
26. Pig Iron (Complete Analysis)
27. Nickel Ore (Ni, Co)
28. Carbon in Steel (Volumetric)
29. Gas Analysis.

Quantitative Analysis.—Conference. (1)

Organic Chemistry.—Lectures and Recitations. (4)

Crystallography.—Lectures, with Practical Exercises in the Determination of Crystals. (2)

French.—Readings. Dictation. Compositions. (2) Or *German.*—Readings. Dictation. Compositions. (2)

Conversation Class in both languages optional throughout the year.

Gymnasium. (2)

SECOND TERM.

Organic Chemistry.—Laboratory. (5)

Organic Chemistry.—Conference. (1)

Metallurgy.—Metallurgical Processes. Furnaces. Refractory Building Materials. Combustion. Natural and Artificial Fuels. Metallurgy of Iron. (4)

French.—Readings. Compositions. Lectures on French Literature. (2) Or *German.*—Readings. Compositions. Lectures on German Literature. (2)

Mineralogy.—Descriptive Mineralogy, with Practical Exercises in the Determination of Minerals. E. S. Dana. (3)

Essays and Original Orations. (1)

Gymnasium. (2)

SENIOR CLASS.

FIRST TERM.

Metallurgy.—Of Copper, Lead, Silver, Gold, Platinum, Mercury, Tin, Zinc, Nickel, Cobalt, Arsenic, Antimony and Bismuth. (5)

Assaying.—Including the Assay by the dry methods of

Gold, Silver, Antimony, Lead, Iron and Tin ores, Coal, Gold and Silver Bullion and rich Lead. Ricketts. (3)

Organic Chemistry.—Laboratory. (4)

Organic Chemistry.—Conference. (1)

Geology.—Williams' Lithology, with Practical Exercises in determining rocks. (3)

Gymnasium.

SECOND TERM.

Industrial Chemistry.—Lectures and Laboratory. (4)

Agricultural Chemistry.—Lectures. (1)

Sanitary Chemistry.—Laboratory. (1)

Geology.—Historic and Dynamic Geology. Lectures. Geikie. (2)

Christian Evidences.—Lectures. (1)

Lectures on American and English Literature. (2)

Preparation of Thesis. (5)

Gymnasium.

PHYSICAL CULTURE.

The Gymnasium is open morning, afternoon and evening, in all, 45 hours a week. Exercise in it is required of all students who are fitted to take it. Class drill with the Instructor and individual exercise are prescribed.

GRADUATING THESES.

Every student will be required to present a thesis upon some topic connected with his special course, as a necessary portion of the exercises for his final examination for a diploma. These theses shall be accompanied by drawings and diagrams, when the subjects need such illustration. The originals will be kept by the University, as a part of the student's record, for future reference; but a copy may be retained by the student, and be published, permission being first obtained from the President.

DIPLOMAS AND CERTIFICATES.

The Diploma is given only to those who have passed all the examinations in a regular course and is signed by the President and Secretary of the Board of Trustees and by the Faculty of the University. For all the partial courses a certificate, signed by the President and the Secretary of the Faculty, is given showing what the student has accomplished.

GRADUATE STUDENTS.

Graduate students wishing to remain a year or more and pursue a course of study as candidates for another Degree may do so with the sanction of the Faculty. Those wishing to take *special* courses of study will be afforded every facility for so doing.

POST GRADUATE DEGREES.

M. A.

The Faculty will recommend for the Degree of Master of Arts any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Arts, shall pursue, for at least one year at this University, or two years elsewhere, a course of liberal study prescribed by the Faculty in at least two departments, pass a satisfactory examination in the same and present a satisfactory Thesis.

M. S.

The Faculty will recommend for the Degree of Master of Science any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Bachelor of Science, or any Degree in the School of Technology, shall pursue, for at least one year at this University, or two years elsewhere, a course of study prescribed by the Faculty in at least two departments, pass a thorough examination in the same and present a satisfactory Thesis.

Ph. D.

The Faculty will recommend for the Degree of Doctor of Philosophy any Candidate, otherwise properly qualified, who, after taking at this University the Degree of Master of Arts or Master of Science, shall pursue, for at least one year at this University, or two years elsewhere, a course of advanced study prescribed by the Faculty, in at least two departments, pass a thorough examination in the presence of the Faculty in the same and present a satisfactory Thesis giving evidence of original investigation.

The Candidate shall have a good knowledge of Latin and either French or German.

The Theses presented by Candidates for Post Graduate Degrees shall be retained by the University.

Applicants for any of these degrees will be required to complete the prescribed work within the allotted time. Special action of the Faculty is required for any extension of time.

THE UNIVERSITY LIBRARY.

The Library building was erected by the Founder of the University in 1877, at a cost of One Hundred Thousand Dollars, as a memorial of his daughter, Mrs. Lucy Packer Linderman, and during the same year more than Twenty Thousand Dollars were contributed by her family and friends, as a memorial fund for the purchase of books. By the will of the Founder of the University a fund of $500,000 has been given for the permanent endowment of the library.

The building is semi-circular in plan, with a handsome façade in the Venetian style of architecture. It is constructed of Potsdam sandstone with granite ornamentation. In the interior, the center is occupied as a reading space, fifty by forty feet, from which radiate the book cases, extending from floor to ceiling; two galleries affording access to the upper cases. Shelf room is now provided for one hundred and sixty thousand volumes. The building is thoroughly fireproof, well lighted, and heated by steam.

Seventy-five thousand volumes are now upon the shelves, including many extremely valuable works. The list of periodicals numbers about one hundred and twenty-five, embracing as far as possible all departments of knowledge.

The Library is conducted strictly for consultation, and is open to the use of the public; both of which conditions are in accord with the terms of the gift.

REGULATIONS OF THE LEHIGH UNIVERSITY LIBRARY.

I. The Library is open every day, except Sundays and Legal Holidays, from 8 A. M. until 10 P. M., and on Sundays for the students and others connected with the University from 1.30 P. M. until 9.30 P. M.

II. Admission is free to all persons over 16 years of age.

III. Readers are required to write their names and addresses in the Daily Register of the Library. They also write the name of the book desired upon a Library Card, with their signatures, and present the same to the Director's Clerk, who supplies the book, retaining the card as a receipt. Before leaving the Library, readers return their books to the clerk, and receive their cards.

IV. The University Professors and Instructors, only, are allowed to take books from the Library Building.

V. No person is allowed to enter the alcoves, or remove any book from the shelves, without permission of the Director.

VI. Readers wishing to consult the more valuable illustrated works make special application for that purpose.

VII. In taking notes, pencils, and not pens and ink, are to be used.

VIII. Audible conversation and the use of tobacco are strictly forbidden in any part of the Library.

IX. Any person not conforming to these Regulations, will be denied the privilege of the Library.

X. Any person, who defaces, in any way, any book, magazine or paper, or the furniture, or any portion of the building, in addition to being deprived of the privileges of the Library, will be prosecuted according to law.

OBSERVATORY.

By the liberality of Robert H. Sayre, Esq., one of the Trustees of the University, an Astronomical Observatory was erected on the University grounds, and placed under the charge of the Professor of Mathematics and Astronomy.

In the dome of the Observatory is mounted an Equatorial Telescope, of six inches aperture, by Alvin Clark & Sons. The west wing contains a superior Sidereal Clock, by Wm. Bond & Sons; a Zenith Telescope, by Blunt, and a Field Transit, by Stackpole. There is also a Prismatic Sextant, by Pistor & Martins.

Students in Practical Astronomy receive instruction in the use of the instruments and in actual observation.

The grounds upon which the Observatory stands, consisting of seven acres of land adjoining the original grant, was presented to the University by Charles Brodhead, Esq., of Bethlehem.

An advanced course in Astronomy and the higher Analysis has been established, requiring two years for its completion. It is adapted to the attainments of the graduates of this University, but, is open to any one who may be prepared to pursue it.

This course embraces the following subjects:

First Year.—Spherical Astronomy. Theory of Instruments. Method of Least Squares. Numerical Calculus.

Second Year.—Celestial Mechanics. Interpolation and Quadrature. Computation of Orbits and Perturbations.

During the entire course the student will have ample opportunity to familiarize himself with the practical work of the Observatory and Computing Room.

THE PACKER MEMORIAL CHURCH,

is the recent and munificent gift of Mrs. Mary Packer Cummings, daughter of the Founder of the University. It is a large and magnificent Church, richly furnished and handsomely appointed in every particular. There is no more beautiful Church edifice in the State and it is one of the noblest in all the land. It is under the Rectorship of the Right Reverend Nelson Somerville Rulison, D.D., Assistant Bishop of Central Pennsylvania, with the Chaplain of the University as Assistant.

THE UNIVERSITY MUSEUM.

In addition to the large collection illustrating all branches of Industrial Chemistry, the Museum includes collections in Metallurgy, Geology, Zoology, and Archæology.

The Metallurgical Cabinet already includes specimens illustrating the various processes for obtaining the more common metals.

The Zoological Cabinet includes the Werner collection of nearly all the types of American birds with their nests and eggs, and the Packer collection of recent shells.

The Geological Cabinet numbers over ten thousand specimens and includes the Palæontological, Mineralogical, Petrographic and Economic collections. The former contains good specimens of nearly all the common genera. The Mineralogical division includes the Keim and Rœpper collections—the latter being especially complete and valuable from a crystallographic stand-point. The Petrographic division numbers several thousand specimens and besides including numerous varieties of nearly all the rocks of the globe, contains a duplicate set from the collection of the Second Geological Survey of this State. The Economic division was formed and donated by Dr. James P. Kimball, Director of the Mint, and formerly Professor of Economic Geology.

The Cummings Archæological Cabinet numbers three thousand specimens and includes Dr. Stubbs' Collection of Indian relics, weapons, and utensils.

THE CHEMICAL AND NATURAL HISTORY SOCIETY OF THE LEHIGH UNIVERSITY.

This Society was organized in the Fall of 1871, as "The Chemical Society," but was afterwards expanded, as its present title indicates, and admits, by election, students from all departments of the University.

The collections of Botanical and Zoölogical Specimens belonging to the Society, are already important. During the past years persons have been sent to Texas and Brazil to collect specimens for these cabinets.

The Society has organized and maintained several courses of public scientific lectures.

Among the honorary members of the Society are more than one hundred of the most distinguished scientists in Europe and the United States.

The annual address was delivered by Prof. Ira Remsen, on June 16, upon "The Relations between Chemical Science and Chemical Industry."

THE ENGINEERING SOCIETY.

This society was organized in 1873, and admits, by election, students in the Junior and Senior Classes. Its meetings are held fortnightly. At these, papers relating to engineering subjects are read and discussed. It issues quarterly "The Journal of the Engineering Society" to which the members and others contribute.

THE MINING CLUB.

This was organized in 1883 and takes from the Junior, Senior, and Post Senior Classes, those members of the Mining School who excel in their studies or in practical experience in the subjects of the course.

THE ELECTRICAL ENGINEERING SOCIETY

was organized in November, 1887, by students in the Advanced Course in Electricity. Its object is to supplement the regular work of the department by the study and discussion of electrical subjects.

THE AGORA

is a Literary Society which meets semi-monthly—only students in the Course of General Literature are eligible to membership.

THE ATHENÆUM.

is also a Literary Society whose active membership is confined to the Sophomore Class. The meetings are held weekly.

THE UNIVERSITY GUILD

is a Society for the promotion of the religious, mental, moral and social life of the students of the University. The Right Reverend, the Assistant Bishop of Central Pennsylvania, is Honorary President and the Chaplain of the University, Honorary Vice-President. Its meetings are held fortnightly at the residence of the Chaplain. It is an active and flourishing society of important and growing influence.

FOUNDER'S DAY.

On the second Thursday of October of each year Commemorative Exercises are held in honor of the Founder of the University.

WASHINGTON'S BIRTHDAY.

This day is observed as a holiday.

On Wednesday, February 22, 1888, exercises were held in the Chapel, and orations were delivered by Messrs. Morrow, Campbell, Farwell, Throop and Atkinson.

UNIVERSITY SERMON.

This sermon is preached on the Sunday before University Day.

The Rev. Samuel D. McConnell, D.D., was the preacher on Sunday, June 17, 1888, in the Memorial Church.

THESES.

Theses on the following subjects were prepared by the graduating class of 1888.

"Hydraulic Forging Machine."

CHARLES LAMBERT ADDISON.

"Mechanical Refrigeration."

GEORGE READE BALDWIN.

"Four American Centennials."

CHARLES LINCOLN BANKS.

"The Use of the Gradienter, and the Precision of Gradienter Measurements."

EDMUND A. BATES.

"A Review of the Pratt Truss Skew Bridge, Pennsylvania Railroad, near Pottsville, Pa."

WILLIAM DONALDSON BEATTY.

"Review of the Iron Highway Bridge over the Schuylkill River at Royersford, Pa."

HUBERT ALEXANDER BONZANO.

"The Discharge and Mean Velocity of the Lehigh River, at Different Stages of Water."

WILLIAM BRADFORD.

"Experiments on the Radiation of Heat from Locomotive Boilers."

ADOLPH THEODORE BRUEGEL.

"Computations of Earthwork in Railroad Location."

CHARLES NOBLE BUTLER.

"Economic Location of Radebaugh Branch, S. W. Pa. Ry. with Designs for the Required Structures."

MORTON LEWIS BYERS.

"Design for a Radial Drill."

JOHN JESSE CLARK.

"The Water Supply of Reading, Pa."

GEORGE PHILIP CONNARD.

"The Friedensville Zinc Mines as a Water Supply of the Bethlehems, with Estimates of the Costs."

REUBEN DANIELS.

"Design of a Steel Highway Bridge, with Specifications."

GEORGE HERSCHEL DAVIS.

"The Canal and Slack Water Navigation of the Schuylkill River."

WILLIAM SCHAFF DAVIS.

"The Coal Cars of the Lehigh Valley Railroad."

PHILIP HOFFECKER DE WITT.

"An Investigation of Retaining Walls."

MANUEL VICTOR DOMENECK.

"On Coupling the Pittsburgh Pumping Engines."

GEORGE PATTERSON DRAVO.

"The Construction and Maintenance of Roads within Twenty Miles of Bethlehem."

CHARLES WESLEY FOCHT.

"Design for a Five-Ton Portable Crane."

George Steinman Franklin.

"Discussion of Lehigh University Precise Triangulation with Comparison of Astronomical and Geodetic Co-ordinates of the Sayre Observatory Dome."

Samuel Wilson Frescoln.

"Precision of Stadia Measurements."

William Gates, Jr.

"Analysis and Design of Valve Gearing and Balanced Valve for Twenty Horse Power High Speed Engine."

James Bolan Glover.

"Design for a Shaping Machine."

Hughlett Hardcastle.

"Locomotives with Compound Cylinders."

George Augustus Hart.

"Switches, Frogs and Crossings."

Sterry Henry Jencks.

"The Separation of the Isometric Amylic Alcohols formed by Fermentation."

Frederick Hayes Knorr.

"Forms of Railroad Rails and their Relation to the forms of Wheel Flanges."

James Struthers Mack.

"Construction and Investigation of Brinton Ribbed Arch, over Turtle Creek, on the Pittsburgh Division, Pennsylvania Railroad."

Charles Donnell Marshall.

"Masonry Bridges for Railroad Purposes."

HOWARD HALE McCLINTIC.

"Determination of Cylinder Condensation with Analysis of Experiments."

WALTER ASHFIELD McFARLAND.

"The Analysis of a Meteorite."

HOWARD LEOSER McILVAINE.

"The Future Water Supply of the Bethlehems, with a Precise Determination of the Capacity of the South Bethlehem Reservoirs."

CHARLES HENRY MILLER.

"Plate Girders vs. Stone Arches."

GEORGE PHILIPS MILLER.

"The Georges Creek & Cumberland Railroad"

JOHN HOFF MILLHOLLAND.

"Photography."

HARLAN SHERMAN MINER.

"Design of an Hydraulic Ingot Crane."

HARRY SEMPLE MORROW.

The Intense Element in American Literature."

WILLIAM LYNVILLE NEILL.

"The Chemistry of Coal Gas, Water Gas and Natural Gas."

HOWARD SEGAR NEIMAN.

"Discussion of Base Line Measurements made at Lehigh University in 1886 and 1887."

HARRY PALMER.

"A Review of the Water Supply of Newark, N. Y."

CHARLES JEREMIAH PARKER.

"The Manufacture of Sulphuric Acid of 62° Baumé."

ROBERT SWAIN PERRY.

"The Formation of Modern Europé."

ALBERT GEORGE RAU.

"A Review of Inter-Oceanic Canal Schemes."

CLARENCE ELMER RAYNOR.

"A Comparison of Economy between two Systems of Bridges of Three Hundred Feet Span."

WILLIAM PEMBERTON RICHARDS.

"Slope or Stripping; a Comparison of the Advantages of these two Methods of Mining Coal."

OSMOND RICKERT.

"Plan for the Separate System of Sewage, South Bethlehem, Pa."

EUGENE HICKS SHIPMAN.

"Comparison of Three Locomotive Valve Gears."

WILLIAM ALONZO STEVENSON.

"Design for an Open-Side Planer."

WILMER MARSHALL WEBB.

"Design of a Wrought-Iron Deck Bridge of 96′ 9″ span, and a Comparison with a Through Bridge of the same length."

HARVEY MUSSER WETZELL.

"Review of the Chesapeake & Delaware Canal."

WINTER LINCOLN WILSON.

"Design of a Steel Railroad Bridge and a Comparison with a Wrought-Iron Bridge of the same Span."

EDWARD BENJAMIN WISEMAN.

"Review of Japanese Railways based upon Wellington's Economic Theory of Railroad Location."

SHUNTARO YAMAGUCHI.

"Comparison of Six Cantilever Trusses of Equal Span."

LUTHER REESE ZOLLINGER.

THESES FOR THE DEGREE OF E.M.

"Heat Requirement of an Anthracite Blast Furnace."

FRANK FIELDING AMSDEN.

"Review of the Method of Preparing Anthracite Coal at Lyken's Valley."

ROBERT WEBB BARRELL, B.M.

"A Review of the South Welsh Method of Copper Smelting as practiced by the Baltimore Copper Smelting & Rolling Company."

HENRY BENJAMIN CHARLES NITZE, B.S.

"The Clapp-Griffiths Process."

FRANCIS WILLIAM BURCHAL PILE, B.S.

"The Manufacture of Charcoal and Wood Alcohol."

RUFUS KING POLK, B.S.

"Discussion and Calculations for an Hydraulic Crane."

WILLIAM RICHARD SATTLER, M.E.

"A determination of the best method for the treatment of Cerro de Pasco Silver ore, with an account of the mines."

THEODORE STEVENS, B.M.

"A Review of the Lykens' Valley Electric Motor."

HARRY HARKNESS STOEK, B.S.

"On the Classification and Determination of the Plagioclases, with Special Reference to Szabo's Method, and the Optical Examination according to Max Shuster."

HENRY AUGUSTUS JULIUS WILKINS, B.S.

"Bessemer Converter Linings."

FRANK WILLIAMS, B.S.

UNIVERSITY DAY.

This day is the last of the academic year and falls in 1889 on the third Thursday in June. On this day orations are delivered by members of the Graduating Class, and Degrees are conferred.

EXERCISES ON JUNE 21, 1888.

Reading of Scripture and Prayer by the Rt. Rev. M. A. de Wolfe Howe, D.D., LL.D., Bishop of the Diocese.

Salutatory Oration.—"A Lesson from Rip Van Winkle."

ALBERT GEORGE RAU.

Oration.—"Our Twin Curses of Idleness and Overwork."
JAMES BOLAN GLOVER.

Oration.—"Competition."
ROBERT BROWNE HONEYMAN.

Oration.—"The Philosopher's Stone."
HARLAN SHERMAN MINER.

Valedictory Oration.
SAMUEL WILSON FRESCOLN.

Award of the Wilbur Scholarship to
AARON HOWELL VAN CLEVE
of Easton, Pa., first in rank in the Sophomore Class.

The Wilbur Prizes were awarded as follows:

Sophomore Class, Modern Languages,
GEORGE EDWARD WENDLE.

Freshman Class, Mathematics,
WALTER FORSTALL,
DOMINGO ANTHONY USINA,
ROBERT SCHMITZ.

Freshman Class, Free Hand Drawing,
BENJAMIN WILLIAM HOMANS,
JOHN ZOLLINGER MILLER.

Award of Certificates for the Advanced Course in Electricity.

The following degrees were conferred:

B.S.

CHARLES LINCOLN BANKS,
WILLIAM LYNVILLE NEILL,
ALBERT GEORGE RAU.

C.E.

Edmund A. Bates,
William Donaldson Beatty,
Hubert Alexander Bonzano,
William Bradford,
Charles Noble Butler,
Morton Lewis Byers,
George Philip Connard,
Reuben Daniels,
George Herschel Davis,
William Schaff Davis,
Philip Hoffecker DeWitt,
Manuel Victor Domenech,
Charles Wesley Focht,
Samuel Wilson Frescoln,
William Gates, Jr.,
Sterry Henry Jencks,
James Struthers Mack,
Howard Hale McClintic,
Charles Donnell Marshall,
Charles Henry Miller,
George Philips Miller,
John Hoff Millholland,
Harry Palmer,
Charles Jeremiah Parker,
Clarence Elmer Raynor,
William Pemberton Richards,
Osmond Rickert,
Eugene Hicks Shipman,
Harvey Musser Wetzel,
Winter Lincoln Wilson,
Edward Benjamin Wiseman,
Shuntaro Yamaguchi,
Luther Reese Zollinger.

M.E.

Charles Lambert Addison,
George Reade Baldwin,
Adolph Theodore Bruegel,
John Jesse Clark,

George Patterson Dravo,
Francis Rouad Dravo,
George Steinman Franklin,
James Bolan Glover,
Hughlett Hardcastle,
George Augustus Hart,
Walter Ashfield McFarland,
Harry Semple Morrow,
William Alonzo Stevenson,
Wilmer Marshall Webb.

B.S.

(In Mining and Metallurgy.)

Louis Prevost Gaston,
Robert Browne Honeyman,
Alfred Eli Lewis, Jr.,
Francis William Birchal Pile,
Wyndham Harvey Stokes.

A.C.

Frederick Hayes Knorr,
Howard Leoser McIlvain,
Harlan Sherman Miner,
Howard Segar Neiman,
Robert Swain Perry.

E.M.

Robert Webb Barrell, B. M.,
Henry Benj. Chas. Nitze, B. S.,
Francis William Burchal Pile, B.S.
Rufus King Polk, B. S.,
Theodore Stevens, B. M.,
Harry Harkness Stoek, B. S.,
Henry Aug. Julius Wilkens, B. S.,
Frank Williams, B. S.

The Benediction was then pronounced by the Bishop.

THE WILBUR SCHOLARSHIP.

This Scholarship was founded in 1872 by E. P. Wilbur, Esq., of South Bethlehem, and is the sum of $200 awarded annually to the student in the Sophomore Class having the best record.

THE ALUMNI SCHOLARSHIP.

The Alumni Association of the University has established a Scholarship of the value of $250 per annum, subject to the following conditions :

1. That the Scholarship shall only be awarded to a student really in need of it.

2. That the Scholarship shall not apply to the first year of any student's course ; he must without this aid have gone through one year, and must be prepared to start the second year free from all conditions.

3. That the Scholarship shall not be continued to a student who shall at any time during his course carry any condition over eight weeks beyond the date of the examination in which he failed.

Subject only to the above conditions the disposal of the fund shall until otherwise directed be in the hands of the President of the University.

WILBUR PRIZE.

By the generosity of E. P. Wilbur, Esq., a fund has been established yielding an annual income of $100, for distribution in prizes as the Faculty shall determine.

ALUMNI PRIZES FOR ORATORY.

The "Alumni Association of the Lehigh University" has established an Annual Sum of Fifty Dollars, to be distributed as prizes for excellence in Oratory, subject to the following

REGULATIONS.

1. The Contest shall be held on the 22d day of February, or on the day designated by the University to commemorate the birthday of Washington.

2. There shall be a first prize of $25, a second of $15, and a third of $10.

3. To entitle one to be a competitor he must be a member of the Junior Class, taking a regular course.

4. Subjects for the oration shall be announced at the beginning of the first Term of every year and upon one of these, each competitor shall write an oration not to exceed eight minutes in delivery.

5. Each oration shall bear upon its first page a fictitious name or motto, and shall be accompanied by a sealed envelope, which shall be superscribed with the same name or motto, and an address by which it may be reclaimed. The envelope shall contain the real name and address of the writer, with the declaration that the oration is his own original work. The examiner, having adopted a standard of excellence, may reject any or all of the orations presented which do not attain to this standard; of such as do —should they be sufficient in number—the best six shall be chosen, and their envelopes opened. The others shall be returned to the address given with their envelopes unopened.

6. The Executive Committee of the Alumni Association, or a committee of not fewer than three to be appointed by them, shall hear the competitors, whose oration shall have been approved, and the awards shall be made by a majority of these Judges.

7. In awarding the prizes the judges shall consider both the literary merits and the delivery of each oration.

8. These rules are subject to amendment by the Faculty.

At the last contest, the First Prize was awarded to

WILLIAM DOLLOWAY FARWELL,

the Second, to

PEARCE ATKINSON,

and the Third, to

JOHN THOMAS MORROW.

The next contest will take place February 22, 1889.

ENTRANCE EXAMINATION PAPERS.

Used at the Examination in 1888.

[Requests for other examination papers than those herein printed can not be granted.]

I.—ENGLISH GRAMMAR.

1. When are words said to be "*derivative*" and when "*compound?*" Give examples of each.

2. What classes of words are compared? Give examples of the regular comparison of words both by prefixes and suffixes; also, of irregular comparison, and of words of the same classes which do not admit of comparison.

3. What are the names of the different classes of pronouns?

4. What particular pronouns are varied in form to denote gender?

5. Write sentences in which the relative *who*, *which*, *what* and *that* are properly used.

6. What is meant by *case* in nouns and pronouns?

7. What *properties* (or *modifications*, *attributes*, etc.,) have verbs?

8. What is *mood? tense?*

9. What moods can not be used in interrogative sentences?

10. What tenses can be formed without auxiliaries?

11. Give the second person singular of the verb *be* in the several moods and tenses.

12. What class of verbs admit of the passive form, and of which principal part and which auxiliary verb is this form constructed? Give the first person singular passive of the verb *see*, in each of the moods and tenses.

13. What are the principal parts of the following verbs: *lay*, *lie*, *lead*, *make*, *ride*, *see*, *swim*, *write?*

14. Of what does syntax treat?

15. In the clause, "*If it be proved against an alien*," etc., in what mood is the verb, and why?

16. Parse "*only*" in the phrase, "*Of the duke only.*"

17. What is the principal or leading clause in the sentence, "*In which predicament I say thou stand'st.*"

18. Parse "*which*" in the same sentence.

19. Give the principal parts of "*say*" and "*stand'st.*"

20. Parse the verb in "*Thou hast incurred the danger*," giving the voice mood, tense, person, number, subject, and rule of syntax.

21. Change the quotation in question number 20 to the *passive* form.

22. Parse "*down*" in the sentence, "*Down, therefore, and beg mercy of the duke*," giving particulars required in question number 20.

23. In what case is "*mercy*," and why?

24. Parse "*therefore.*"

II.—GEOGRAPHY.

1. Give the courses of the following rivers and the States through, or on the border of which they flow: Connecticut, Arkansas, and Tennessee.

2. Bound Georgia, New York, Colorado, and give the capital, principal rivers and mountains of each.

3. In what States and where are the following: Austin, Baton Rouge, Olympia, and Augusta?

4. Through what States would a straight line from Salem, Oregon, to Key West, Florida, pass?

5. Name and locate the Capitals of Illinois, Mississippi, Florida, North Carolina, and Rhode Island?

6. Through what waters would you sail westward from San Francisco to New York, *via* Singapore and the Cape of Good Hope?

7. Name and locate the principal cities of Hungary, Saxony, China, New South Wales, and Scotland.

8. Bound the following: Mexico, Peru, Italy, Persia, and Siberia.

9. Locate the following: Copenhagen, Glasgow, Moscow, Alexandria, and Bombay.

10. Locate the Euphrates, Isthmus of Corinth, North Sea, Don, and Straits of Gibralter.

III.—UNITED STATES HISTORY.

1. Give the leading events in the early history of New York.

2. When and where did the second continental congress meet, what were its principal dispositions in behalf of the army and navy? Give the names of some of the most distinguished men of that body.

3. When and where did the federal convention meet? Who presided over it? What were the results?

4. Give the leading events, domestic and foreign, of the two terms of Monroe's administration.

5. What were the provisions of the Fugitive-Slave Law? What was its worst provision? What its effect?

6. What was the federal policy? What was the condition of the South at Lincoln's inauguration?

7. What were the leading events during the second term of Grant's administration?

8. How are disputed elections decided? May any of the proceedings of Congress be kept secret? May either branch adjourn without the consent of the other?

9. How are the States protected?

10. Who has power to enforce the XIVth amendment?

IV.—ARITHMETIC.

1. (*a*) Give definition of an integer; a prime number; a prime factor.

(*b*) What is the greatest common divisor of two numbers? The least common multiple?

(*c*) Explain process of subtracting fractions; of reducing a common fraction to a decimal; of reducing a decimal to a common fraction.

2. (*a*) Give number of square rods in an acre; number of cubic feet in a cord of wood; number of pints in a dekalitre.

(*b*) What is percentage? What are discount and bank discount? What is real estate?

(*c*) What is ratio? What is a proportion? What are the assets and liabilities of a firm?

3. $[2 . \frac{27}{2} - 1.019 + \frac{2}{15}] \div [516.04 - \frac{27}{4} + .002]$ Reduce to decimal, and explain rule for position of decimal point.

4. If distance from the Sun Hotel to Packer Hall is $1\frac{1}{8}$ miles, what is the number of kilometres? Of centimetres?

5. Find interest, discount, and bank discount on $416.03 for 60 days, at $7\frac{1}{2}$ %.

6. A miller mixes 18 bushels of wheat at $1.44 with 6 bushels at $1.32, 6 bushels at $1.08, 12 bushels at $0.84. What will be his gain per bushel if he sells the mixture at $1.50?

7. A square field contains 1,016,064 sq. feet. What is the length of a side expressed in metres?

V.—GEOMETRY.

1. (*a*) Define an angle; a right angle; an oblique angle; a straight line.

(*b*) Define a plane; diedral angle; plane-angle of diedral angle; convex polyedral angle.

(*c*) Define a geometric locus, and give three examples of loci.

2. (*a*) Define similar polygons; a regular polygon. State relation of areas of similar polygons.

(*b*) Under what conditions will two triangles be similar? Under what conditions will they be equal?

(*c*) State the various conditions under which a quadrilateral is a parallelogram.

3. Two triangles are equal when the three sides of the one are respectively equal to the three sides of the other.

4. The medial lines of a triangle meet in a point.

5. At a given point on the circumference to draw a tan-

gent to the circle. From a given point without to draw a tangent to a circle.

6. If through a fixed point in the plane of a circle a chord is drawn, the product of its two segments is the same regardless of its direction.

7. Show how to construct a polygon similar to a given polygon and having two-thirds its area.

8. Of all isoperimetric polygons having the same number of sides the regular polygon is a maximum.

9. If a straight line is perpendicular to each of two lines at their intersection it is perpendicular to their plane.

10. The acute angle which a line makes with its own projection on a plane is the least angle which it makes with any line of the plane.

VI.—ALGEBRA.

1. (*a*) Give definitions of quantity ; mathematics ; algebra.

(*b*) What are factors? What is a monomial? A polynomial?

(*c*) What is the reciprocal of a quantity? What is the reciprocal of zero?

2. (*a*) Explain process of dividing one polynomial by another.

(*b*) What is a prime quantity? What is the least common multiple of two or more quantities?

3. (*a*) What is the degree of an equation? What is an identical equation.

(*b*) Explain process of elimination by comparison.

(*c*) Show that every equation of the second degree containing only one unknown quantity can be reduced to the form $x^2 + px = q$.

4. Reduce the following fractions to their simplest form :

$$\frac{4ax}{3by} \times \frac{a^2 - x^2}{c^2 - x^2} \times \frac{bc + bx}{a^2 - ax}, \qquad \frac{a + b + \frac{b^2}{a}}{a + b + \frac{a^2}{b}}.$$

5. Solve the following equations:

$$\frac{1}{x} + \frac{1}{2x} - \frac{1}{3x} = \frac{7}{3}, \qquad \frac{x}{a} - 1 - \frac{dx}{c} + 3ab = 0.$$

6. The hour and minute hand of a clock are together at noon; when are they next together?

7. Solve the following equations:

$$\left\{ \begin{aligned} \tfrac{1}{3}(x+y) + \tfrac{1}{4}(x-y) &= 59, \\ 5x - 33y &= 0. \end{aligned} \right\} \qquad \left\{ \begin{aligned} \frac{1}{x} + \frac{1}{y} &= a. \\ \frac{1}{x} + \frac{1}{z} &= b. \\ \frac{1}{y} + \frac{1}{z} &= c. \end{aligned} \right\}$$

8. Reduce to the following equivalent expressions having rational denominators:

$$\frac{8 - 5\sqrt{2}}{3 - 2\sqrt{2}}, \quad \frac{1}{x + \sqrt{x^2 - 1}} + \frac{1}{x - \sqrt{x^2 - 1}}, \quad \frac{a + b\sqrt{-1}}{a - b\sqrt{-1}}$$

9. Solve the following equations:

$$\sqrt{2x - 3a} + \sqrt{2x} = 3\sqrt{a}, \qquad \frac{x}{a} + \frac{a}{x} - \frac{2}{a} = 0.$$

10. Solve the following equations:

$$\begin{aligned} x^{\frac{5}{6}} + x^{\frac{5}{3}} &= 1056, \\ (x-2)(x+\tfrac{1}{2})(x-a) &= 0, \end{aligned} \qquad \left\{ \begin{aligned} x(y+z) &= a \\ y(x+z) &= b \\ z(x+y) &= c \end{aligned} \right\}.$$

VII.—PHYSICS.

NOTE.—*The examination in Physics must be passed in June or September of that year in which the candidate proposes to enter the University.*

1. Define (*a*) Energy.
   (*b*) Coefficient of expansion.
   (*c*) Erg.
   (*d*) Index of refraction.
   (*e*) Watt.
2. Give the laws of motion.

3. What weight can be lifted with a screw whose threads are ¼ inch apart, by a power of 100 pounds applied at the end of a lever which describes a circumference of 10 feet?

4. What is the ratio between the quantities of heat which are respectively produced, when a bullet weighing 50 grammes and having a velocity of 500 metres, and a cannon ball weighing 40 kilogrammes with a velocity of 400 metres, strike a target?

5. How much lead at 100° C. (the specific heat of which is 0.0314) is required to melt 10 pounds of ice at 0° C. and raise the temperature of the water to 20° C.?

6. A volume of gas measures 969 cubic inches at 25° C. and at a barometric pressure of 30 inches; what will be its volume if the temperature is raised to 50° C. and the barometric pressure changes to 31 inches?

7. If the object is 10 inches from a convex lens and the screen when the image is sharply defined on it, is 80 inches from the lens, what is the focal length of the lens?

8. Describe a secondary or storage battery.

9. What is meant by the extra current in an induction coil?

10. If a battery with a difference of potential of 12 volts should give a current strength of 0.6 amperes, what must be the internal resistance of the battery, there being no appreciable external resistance?

11. Explain (*a*) Unit strength of magnetic pole.
(*b*) Unit difference of magnetic potential.
(*c*) Intensity of magnetic field.
(*d*) Unit strength of current.
(*e*) Unit of resistance.

VIII.—LATIN.

I.—GRAMMAR.

1. Decline the following nouns, marking the quantity of the penultimate and final syllables through all the cases; *ala*, *genius*, *pars*, *conclave*, *acus*, *acies*. Give the gender of each noun, with rule for it.

2. Decline the adjectives *acer* and *facilis*; the pronouns *quidam* and *uter*. Compare *acer*, *facilis*, *felix*, *malus*. Form adverbs from *pulcher* and *prudens*, and compare them. How do you express in Latin *five*, *fifth*, and *five times?*

3. Give the principal parts of the following verbs, marking the quantity of all the syllables: *sto*, *torqueo*, *cado*, *cœdo*, *cedo*, *ordior*. Inflect the Perfect Subjunctive Active of *cedo*, and the Present Imperative Passive of *ordior*, marking the quantities throughout.

4. What case or cases follow *pudet*, *fungor*, *prœsum*, *doceo?* Translate into Latin: 1. He asked (*rogo*) him whether (*num*) Caius had come (*venio*). 2. He said (*dico*) that Caius would come. 3. He orders (*impero*) Caius to come. 4. He was hindered (*impedio*) by Caius from (*quominus*) coming. 5. He was waiting (*opperior*) until (*dum*) Caius should come. 5. No one (*nemo*) waited who was able (*possum*) to come. 7. If he had waited, I should not have come. 8. Would that (*utinam*) Caius would come. 9. Do not come, Caius.

5. State where each of the following forms is made, and give the principal parts of the verb to which it belongs: *usserit*, *vetaberis*, *texitis*, *sprevissent*, *vinxeram*, *vīdĕris*, *vĭdēris*. Form the III. S. Fut. Pf. Ind. Act. of *parĕre;* II. P. Perf. Ind. Act. of *gignere;* II. P. Fut. Ind. Pass. of *capere;* I. S. Pres. Subj. Pass. of *vocare;* III. P. Imp. Subj. Pass. of *oblivisci;* III. P. Fut. Imperat. Pass. of *haurire;* the Fut. Inf. Pass. of *premere;* the Fut. Part. Pass. of *mittere*. Give a synopsis of *patior*. Inflect the active voice of *fero* throughout.

II.—CAESAR.

Translate:

1. Milites non longiore oratione cohortatus quam uti suæ pristinæ virtutis memoriam retinerent neu perturbarentur animo hostiumque impetum fortiter sustinerent, quod non longius hostes aberant quem quo telum adjici posset, prœlii committendi signum dedit. Atque in alteram partem item cohortandi causa profectus pugnantibus occurrit. Temporis tanta fuit exiguitas hostiumque tam paratus ad dimicandum

animus, ut non modo ad insignia accommodanda, sed etiam ad galeas induendas scutisque tegimenta detrudenda tempus defuerit.—*B. G. II.*

2. Quo prœlio bellum Venetorum totiusque oræ maritimæ confectum est. Nam quum omnis juventus, omnes etiam gravioris ætatis, in quibus aliquid consilii aut dignitatis fuit, eo convenerant, tum navium quod ubique fuerat in unum locum coegerant; quibus amissis reliqui neque quo se reciperent neque quemadmodum oppida defenderent habebant. Itaque se suaque omnia Cæsari dediderunt. In quos eo gravius Cæsar vindicandum statuit, quo diligentius in reliquum tempus a barbaris jus legatorum conservaretur Itaque omni senatu necato reliquos sub corona vendidit.—*B. G. III.*

III.—CICERO.

Translate:

1. Tertium genus est ætate jam affectum, sed tamen exercitatione robustum, quo ex genere iste est Manlius, cui nunc Catilina succedit: sunt homines ex eis coloniis, quas Sulla constituit; quas ego universas civium esse optimorum et fortissimorum virorum sentio, sed tamen ii sunt coloni, qui se in insperatis ac repentinis pecuniis sumptuosius insolentiusque jactarunt. Hi dum ædificant tamquam beati, dum prædiis lectis, familiis magnis, conviviis apparatis delectantur, in tantum æs alienum inciderunt, ut si salvi esse velint, Sulla sit eis ab inferis excitandus.—*In Catilinam, II.* 9.

2. Quod si omnis impetus domesticorum hostium, depulsus a vobis, se in me unum convertit, vobis erit videndum, Quirites, qua condicione posthac eos esse velitis, qui se pro salute vestra obtulerint invidiae periculisque omnibus; mihi quidem ipsi quid est quod jam ad vitae fructum possit adquiri, cum praesertim neque in honore vestro neque in gloria virtutis quidquam videam altius, quo mihi libeat ascendere?—*In Catilinam, III*, 12.

Vobis, *condicione*, *velitis*, *obtulerint*, *possit*, *videam.* What does Cicero mean by *Neque in honore vestro quidquam videam altius?*

IV.—VIRGIL.

Translate:

I. *C.* Muscosi fontes et somno mollior herba,
Et quæ vos rara viridis tegit arbutus umbra,
Solstitium pecori defendite: iam venit æstas
Torrida, iam læto turgent in palmite gemmæ.
T. Hic focus et tædæ pingues, hic plurimus ignis
Semper, et adsidua postes fuligine nigri;
Hic tantum Boreæ curamus frigora, quantum
Aut numerum lupus, aut torrentia flumina ripas.
Ecl. VII., 45–52.

II. Postera iamque dies primo surgebat Eoo,
Humentemque Aurora polo dimoverat umbram:
Cum subito e silvis, macie confecto suprema,
Ignoti nova forma viri miserandaque cultu
Procedit supplexque manus ad litora tendit.
Respicimus. Dira inluvies inmissaque barba,
Consertum tegumen spinis; at cetera Graius,
Et quondam patriis ad Troiam missus in armis.
Æn. III.

III. Anna, vides toto properari litore? Circum
Undique convenere; vocat iam carbasus auras,
Puppibus et læti nautæ inposuere coronas.
Hunc ego si potui tantum sperare dolorem,
Et perferre, soror, potero. Miseræ hoc tamen unum
Exsequere, Anna, mihi; solam nam perfidus ille
Te colere, arcanos etiam tibi credere sensus;
Sola viri mollis aditus et tempora noras;
I, soror, atque hostem supplex adfare superbum;
Æn. IV., 416–424.

V.—SIGHT READING.

Translate:

1. Civitatibus maxima laus est quam latissime circum se vastatis finibus solitudines habere. Hoc proprium virtutis existimant, expulsos agris finitimos cedere neque quemquam prope audere consistere: simul hoc se fore tutiores arbitrantur repentinæ incursionis timore sublato. Quum bellum

civitas aut illatum defendit aut infert, magistratus qui ei bello præsint ut vitæ necisque habeant potestatem deliguntur. In pace nullus est communis magistratus, sed principes regionum atque pagorum inter suos jus dicunt controversiasque minuunt.—*Caesar*, *B. G.*, *VI.*

2. Vixerat M'. Curius cum P. Decio, qui quinquennio ante consulem se pro re publica quarto consulatu devoverat; norat eundem Fabricius, norat Coruncanius: qui quum ex sua vita tum ex eius, quem dico, Decii facto iudicabant esse profecto aliquid natura pulcrum atque præclarum quod sua sponte peteretur quodque spreta et contempta voluptate optimus quisque sequeretur.—*Cato Major*, *XIII*, 43.

VI.—COMPOSITION.

Write in Latin:

1. When[1] the enemy[2] saw[3] that the damages,[4] which they had hoped[5] could[6] not be repaired[7] for a long[8] time,[9] had been so[10] repaired by the toil[11] of a few[12] days[13] that there was no opportunity[14] left[15] for a sally,[16] they were eager[17] for the original[18] terms[19] of capitulation.[20].

1. Ubi. 2. Hostis. 3. Video. 4. Is. 5. Spero. 6. Possum. 7. Reficio. 8. Longus. 9. Spatium. 10. Ita. 11. Labor. 12. Paucus. 13. Dies. 14. Locus. 15. Relinquo. 16. Eruptio. 17. Recurro. 18. Idem. 19. Conditio. 20. Deditio.

VII.—HISTORY,

1. The life of C. Julius Caesar.

2. Laws that are landmarks in Roman History.

3. Mention any reasons that occur to you (1) why Hannibal should have hoped to overcome Rome; and (2) why he failed in his attempt.

4. Give a brief account (with the important dates) of the political career either of Cicero or of Augustus, at your option.

5. Mention the names of the emperors between Domitian and Commodus, in the order of their reigns.

IX.—GREEK.

I.—GRAMMAR.

1. Give the indefinite, demonstrative, and relative adverbs corresponding to the interrogatives *πότε* and *πόθεν*.

2. What is the quantity of the ultima in *σῶμα, χώρα, ἄνθρωποι, ἀγγέλλοι,* and of the penult in *κρῖνε*? What shows in each case, and on what rules?

3. Decline, through all numbers, *δόξα, ὁδός, πατήρ, πόλις.*

4. Compare the adjectives *μέγας, ἡδύς, σοφός,* the adverb *μάλα.*

5. Give the synopsis (*i. e.*, first form in each mode) of the perfect middle, first aorist active, and future active of *φαίνω.* Inflect through the numbers and persons the imperfect active and middle of *τίθημι,* the aorist subjunctive passive of *λύω.*

6. Analyze *λύσουσι.*

7. What prepositions are used with one case only, and with what case respectively?

II.—XENOPHON.

1. Translate:

ἀλλ' ἐγώ φημι ταῦτα μὲν φλυαρίας εἶναι· δοκεῖ δέ μοι ἄνδρας ἐλθόντας πρὸς Κῦρον οἵτινες ἐπιτήδειοι σὺν Κλεάρχῳ ἐρωτᾶν ἐκεῖνον τί βούλεται ἡμῖν χρῆσθαι· καὶ ἐὰν μὲν ἡ πρᾶξις ᾖ παραπλησία οἵαπερ καὶ πρόσθεν ἐχρῆτο τοῖς ξένοις, ἕπεσθαι καὶ ἡμᾶς καὶ μὴ κακίους εἶναι τῶν πρόσθεν τούτῳ συναναβάντων· ἐὰν δὲ μείζων ἡ πρᾶξις τῆς πρόσθεν φαίνηται, ἀξιοῦν ἢ πείσαντα ἡμᾶς ἄγειν ἢ πεισθέντα πρὸς φιλιαν ἀπιέναι.—(An. I. 3, 18.)

Construction of *οἵαπερ* and of *πεισθέντα.* On what does *ἕπεσθαι* depend?

2. Translate:

ταῦτα οὖν φιλοπολέμου μοι δοκεῖ ἀνδρὸς ἔργα εἶναι, ὅστις ἐξὸν μὲν εἰρήνην ἔχειν ἄνευ αἰσχύνης *καὶ βλάβης αἱρεῖται πολεμεῖν, ἐξὸν δὲ χρήματα ἔχειν ἀκινδύνως αἱρεῖται πολεμῶν μείονα ταῦτα ποιεῖν· ἐκεῖνος δὲ ὥσπερ εἰς παιδικὰ ἢ εἰς ἄλλην τινὰ ἡδονὴν ἤθελε δαπανᾶν εἰς πόλεμον.*—(An.II.6,6.)

Construction of *ἐξόν.* Of whom is this character given?

3. Translate:

τοῦτο δὲ λέγοντος αὐτοῦ πτάρνυταί τις· ἀκούσαντες δ' οἱ στρατιῶται πάντες μιᾷ ὁρμῇ προσεκύνησαν τὸν θεόν, καὶ Ξενοφῶν εἶπε, Δοκεῖ μοι, ὦ ἄνδρες, ἐπεὶ περὶ σωτηρίας ἡμῶν λεγόντων, οἰωνὸς τοῦ Διὸς τοῦ σωτῆρος ἐφάνη, εὔξασθαι τῷ θεῷ τούτῳ θύσειν σωτήρια ὅπου ἂν πρῶτον εἰς φιλίαν χώραν ἀφικώμεθα, συνεπεύξασθαι δὲ καὶ τοῖς ἄλλοις θεοῖς θύσειν κατὰ δύναμιν. καὶ ὅτῳ δοκεῖ ταῦτ', ἔφη, ἀνατεινάτω τήν χεῖρα. καὶ ἀνέτειναν ἅπαντες. ἐκ τούτου εὔξαντο καὶ ἐπαιάνισαν.

—(An. III. 2, 9.)

Reason for the subjunctive in *ἀφικώμεθα.* Construction of *ἡμῶν.* Construction of the antecedent of *ὅτῳ.*

4. Translate:

ἐντεῦθεν ἔπεμψαν νυκτὸς Δημοκράτην Τεμενίτην ἄνδρας δόντες ἐπὶ τὰ ὄρη, ἔνθα ἔφασαν οἱ ἀποσκεδαννύμενοι καθορᾶν τὰ πυρά· οὗτος γὰρ ἐδόκει καὶ πρότερον πολλὰ ἤδη ἀληθεῦσαι τοιαῦτα, τα ὄντα τε ὥς ὄντα καὶ τὰ μὴ ὄντα ὥς οὐκ ὄντα. πορευθεὶς δὲ τὰ μὲν πυρὰ οὐκ ἔφη ἰδεῖν, ἄνδρα δὲ συλλαβὼν ἧκεν ἄγων ἔχοντα τόξον Περσικὸν καὶ φαρέτραν καὶ σάγαριν, οἵανπερ αἱ Ἀμαζόνες ἔχουσιν. ἐρωτώμενος δὲ τὸ ποδαπὸς εἴη, Πέρσης μὲν ἔφη εἶναι, πορεύεσθαι δ' ἀπὸ τοῦ Τιριβάζου στρατεύματος, ὅπως ἐπιτήδεια λάβοι.—(An. IV. 4, 15.)

Construction of *νυκτός.* To what does *τό* belong? Reason for the optative in *εἴη* and in *λάβοι.*

III.—HOMER.

1. Translate:

"Ὦ πόποι, ἦ μέγα πένθος Ἀχαιΐδα γαῖαν ἱκάνει.
ἦ κεν γηθήσαι Πρίαμος Πριάμοιό τε παῖδες,
ἄλλοι τε Τρῶες μέγα κεν κεχαροίατο θυμῷ,
εἰ σφῶϊν τάδε πάντα πυθοίατο μαρναμένοιιν,
οἳ περὶ μὲν βουλὴν Δαναῶν, περὶ δ᾽ ἐστὲ μάχεσθαι."
—(Il. I. 254–258.)

Make a list of the forms in these lines peculiar to Homer, adding, in each case, the corresponding Attic form.

Explain the form *κεχαροίατο*.

2. Translate:

"πῆ δὴ συνθεσίαι τε καὶ ὅρκια βήσεται ἡμῖν;
ἐν πυρὶ δὴ βουλαί τε γενοίατο μήδεά τ᾽ ἀνδρῶν,
σπονδαί τ᾽ ἄκρητοι καὶ δεξιαὶ, ᾗς ἐπέπιθμεν·
αὔτως γάρ ῥ᾽ ἐπέεσσ᾽ ἐριδαίνομεν, οὐδέ τι μῆχος
εὑρέμεναι δυνάμεσθα, πολὺν χρόνον ἐνθάδ᾽ ἐόντες."
—(Il. II. 339–343.)

Where is *ἐπέπιθμεν* made? What is the derivation of *σπονδαί*? the reason for the gender of *δεξιαί*? What other forms in Homer of *ἐπέεσσι*? What length of time denoted by *πολὺν χρόνον*?

3. Translate:

ὣς ἄρ᾽ ἔφαν, πάλλεν δὲ μέγας κορυθαίολος Ἕκτωρ
ἂψ ὁρόων· Πάριος δὲ θοῶς ἐκ κλῆρος ὄρουσεν.
οἱ μὲν ἔπειθ᾽ ἵζοντο κατά στίχας ἧχι ἑκάστου
ἵπποι ἀερσίποδες καὶ ποικίλα τεύχε᾽ ἔκειτο·
αὐτάρ ὅ γ᾽ ἀμφ᾽ ὤμοισιν ἐδύσετο τεύχεα καλὰ
δῖος Ἀλέξανδρος, Ἑλένης πόσις ἠυκόμοιο.
ὣς δ᾽ αὔτως Μενέλαος ἀρήιος ἔντε᾽ ἔδυνεν.
—(Il. III. 324–329, 339.)

What was determined by the process described in the first two lines? Why are the words *ἂψ ὁρόων* added? What was the issue of the combat that followed?

IV.—SIGHT READING.

ἐπεὶ δὲ μέγα φρονήσας ὁ Τισσαφέρνης ἐπὶ τῷ καταβάντι στρατεύματι παρὰ βασιλέως προεῖπεν Ἀγησιλάῳ πόλεμον, εἰ μὴ ἀπίοι ἐκ τῆς Ἀσίας, οἱ μὲν ἄλλοι σύμμαχοι καὶ Λακεδαιμονίων οἱ παρόντες μάλα ἀχθεσθέντες φανεροὶ ἐγένοντο, Ἀγησίλαος δὲ μάλα φαιδρῷ τῷ προσώπῳ ἀπαγγεῖλαι Τισσαφέρνει τοὺς πρέσβεις ἐκέλευσεν ὡς πολλὴν χάριν αὐτῷ ἔχοι, ὅτι ἐπιορκήσας αὐτὸς μὲν πολεμίους τοὺς θεοὺς ἐκτήσατο τοῖς δ' Ἕλλησι συμμάχους ἐποίησεν. ἐκ δὲ τούτου εὐθὺς τοῖς μὲν στρατιώταις παρήγγειλε συσκευάζεσθαι ὡς εἰς στρατείαν, ταῖς δὲ πόλεσιν εἰς ἃς ἀνάγκη ἦν ἀφικνεῖσθαι στρατευομένῳ ἐπὶ Καρίαν προεῖπεν ἀγορὰν παρασκευάζειν.

V.—HISTORY.

1. Give a brief account of Demaratos (the friend of Xerxes); of Brasidas; of Pelopidas.
2. Mention any events you recall between the Persian and Peloponnesian wars.
3. Describe the formation of the first Athenian confederacy and the process of its change into an empire.
4. Describe *ostracism.* Against what individuals is it known to have been put into effect?

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George Thomas Richards, C.E., Chief Engineer, McKeesport & Belle Vernon R. R., Pittsburgh, Pa.

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Frank Stuart Smith, A.C., Lamp Department, Westinghouse Electric Light Co., Pittsburgh, Pa.

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Luther Reese Zollinger, C.E., 25 N. Third Street, Harrisburg, Pa.

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Daniel Henry Jenkins, Mutual Electric and Accumulator Co., 76 Ashland Place, Brooklyn, N. Y.

Charles Jacob Miller, Brush Electric Light Co., 720 N. 5th Street, Philadelphia, Pa.,

James Leidy Moore, Thompson-Houston Electric Co., Lynn, Mass.

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* Deceased.

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From Mrs. E. A. de Schweinitz, Bethlehem.

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State Map of New Jersey.
Relief Map of New Jersey.

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Report of Pennsylvania State College. 1886.
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Observations, U. S. Naval Observatory, 1883.

From the Institution of Civil Engineers, London, Eng.

Minutes of Proceedings. Vols. 91. 92. 93.

From the American Society of Civil Engineers.

Transactions of the Society for 1888.

From the American Society of Mining Engineers.

Transactions. Vol. 16.
Index to Transactions.

From the American Iron and Steel Association.

Annual Statistical Report.
Directory to the Iron and Steel Works of the U. S.

From the Alumni Association of Lehigh University.

Proceedings June 1886 to June 1887.
The Labor Problem of To-day, by F. A. Walker.

From the Agricultural College Library, Ingham Co., Mich.

Twenty-Sixth Annual Report of the Michigan Board of Agriculture.

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Twenty-Eighth and Twenty-Ninth Annual Reports of Directors.
Bulletin of New Books. 11 Pamphlets.

From the Boston Public Library.

Bulletin. Vol. 4. No. 11. Vol. 5. Nos. 3. 4. and 7. Vol. 6. Nos. 1. 2. Vol. 7. No. 4. Vol. 8. Nos. 1. 2.

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From the Peabody Museum, Cambridge, Mass.

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Smithsonian Miscellaneous Collections, Vols. 31. 32. 33.

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Poor's Manual of Railroads for 1885.

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From U. S. Navy Department.

Nautical Almanac. 1891.

From U. S. Treasury Department.

Report of Director of the Mint, 1883.

From the Commissioner of Agriculture, Washington. D. C.

Report for 1887.

From Insurance Department of Pa.

Fifteenth Report of Life Insurance.

From the Commissioners of Second Geol. Survey of Penna.

Annual Report for 1886, Parts 1. 2. 3; and Atlas to part 2.
Atlas of Bucks and Montgomery Counties.
Atlas of Western Middle Anthracite Field. Part 2.

From U. S. Department of State.

Consular Reports, Nos. 83 to 92 inclusive.
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Technical Education in Europe. Part 1. By Schoenhof.

From U. S. War Department.

Annual Report of the Chief of Engineers of the U. S. Army, 1886–7- 7 Vols.
Report of Chief Signal Officer, 1886.
Official Army Register, Jan. 1888.
Annual Report of Board of Visitors of U. S. Military Academy.

From U. S. Treasury Department.

U. S. Coast and Geodetic Survey. Report for 1886.

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Annual Report of Commissioner of Patents, 1887.
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Forty-Two U. S. Atlas Sheets.

From the U. S. Bureau of Education.

Circulars of Information Nos. 1 and 2 for 1887.
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Study of History in American Colleges and Universities, By H. B. Adams.
The Republic of Mexico in 1876.
Report of the Mexican Border Commission.

From U. S Civil Service Commission.

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The Register is sent to all graduates who furnish their addresses for the purpose, and to all other persons on application to

THE PRESIDENT OF LEHIGH UNIVERSITY,
South Bethlehem, Pa.